WIRE AND WIRE PRODUCTS

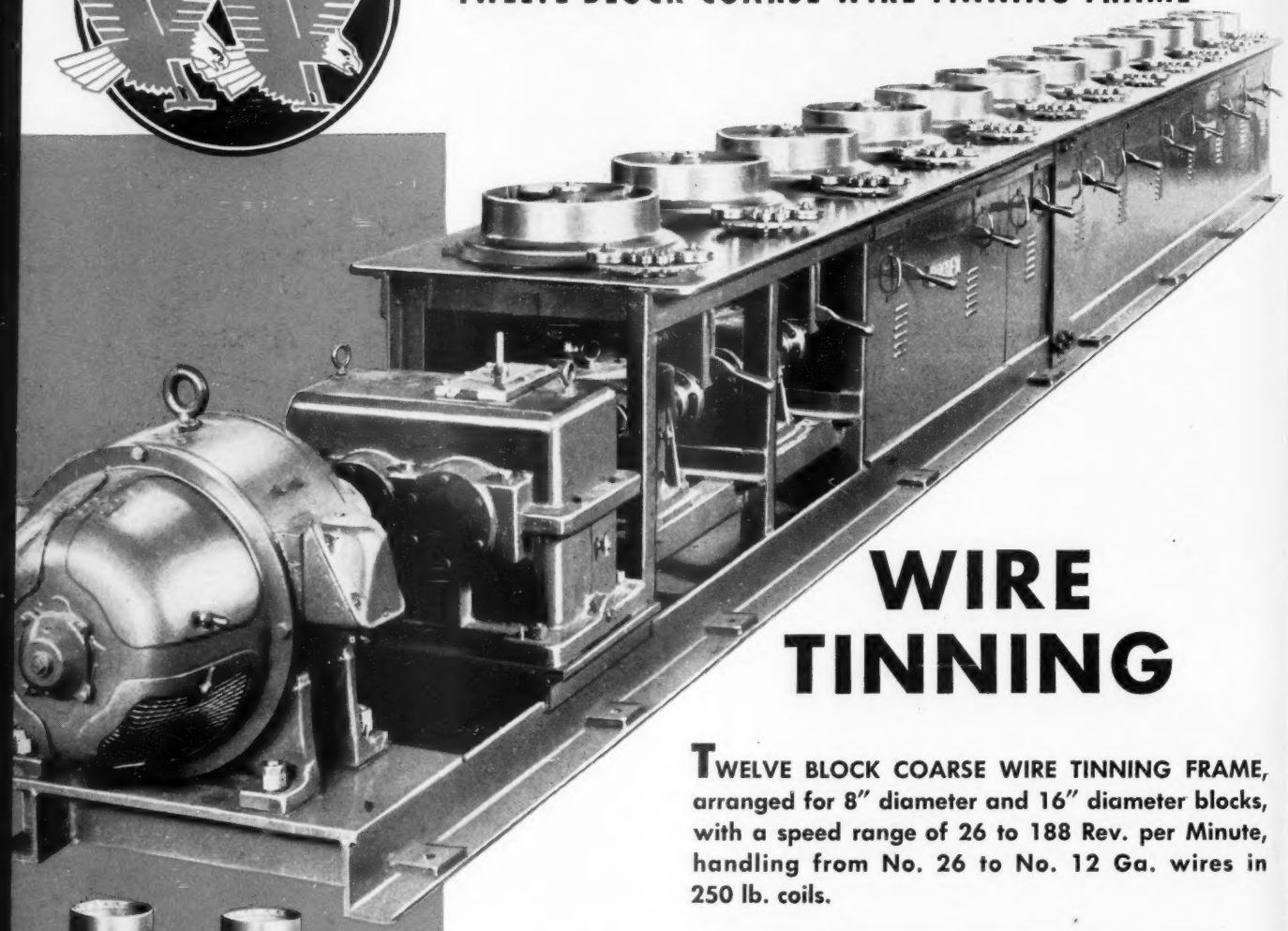
JANUARY 1946

FOR THE SPEED THAT MEANS FASTER PROFITS!
VAUGHN MOTOBLOC & MOTOBLOX
VAUGHN
Higher wire drawing production through more efficient machine performance lowers production costs. Build better profits with VAUGHN MACHINERY this year!
THE VAUGHN MACHINERY COMPANY · CUYAHOGA FALLS, OHIO, U.S.A.
COMPLETE COLD DRAWING EQUIPMENT . . . Continuous or Single Hole . . . for the Largest Bars and Tubes . . . for the Smallest Wire . . Ferrous, Non-Ferrous Materials or their Alloys.

FICIAL PUBLICATION OF THE WIRE ASSOCIATION

WEAN • BRODEN

TWELVE BLOCK COARSE WIRE TINNING FRAME



WIRE TINNING

TWELVE BLOCK COARSE WIRE TINNING FRAME, arranged for 8" diameter and 16" diameter blocks, with a speed range of 26 to 188 Rev. per Minute, handling from No. 26 to No. 12 Ga. wires in 250 lb. coils.

Frame is of the worm-gear driver type, operating at maximum efficiency, noiseless and entirely vibration-free.

We also build these frames for fine wire gauges with 8" diameter blocks and either with or without spooling attachments.

We are in a position to quote on complete installations of small or large capacity.

The two 8" diameter blocks shown above are interchangeable with the 16" diameter blocks on the frame.

The BRODEN CONSTRUCTION Co., Inc., Cleveland,

A SUBSIDIARY COMPANY OF

The WEAN ENGINEERING Co., Inc., Warren, O

Keep.. Bright..... USE

COPPER COATED (LIQUORED) WIRE

. . . . DURING STORAGE--

APEX

SFV

1. Prevents discoloration, oxidation, and rusting.
2. Nothing to wipe off or remove after final draw.
3. Eliminates wet drawing with its attendant disadvantages.

Write today for complete details on Apex SFV for permanently BRIGHT copper-coated wire

Apex Alkali Products Co.

MAIN & RECTOR STS., PHILADELPHIA 27, PA. · PHONE: Manayunk 3930

Tough FORMING JOBS?

GIVE 'EM TO BETHANIZED

Looking for zinc-coated wire that can take it—wire that can stand severe fabrication without losing either its protection or good looks? Give the job to bethanized wire!

Bethanized wire has a smooth, protective coating of 99.9 per cent pure zinc which is actually locked to the steel base by an advanced electrolytic process. So tight is the bond between zinc and steel that the two metals practically become one.

Loosen a bethanized coating? Severe bending won't do it. Nor will twisting. In fact, bethanized wire can even be drawn to a fraction of its original size, without loss of coating.

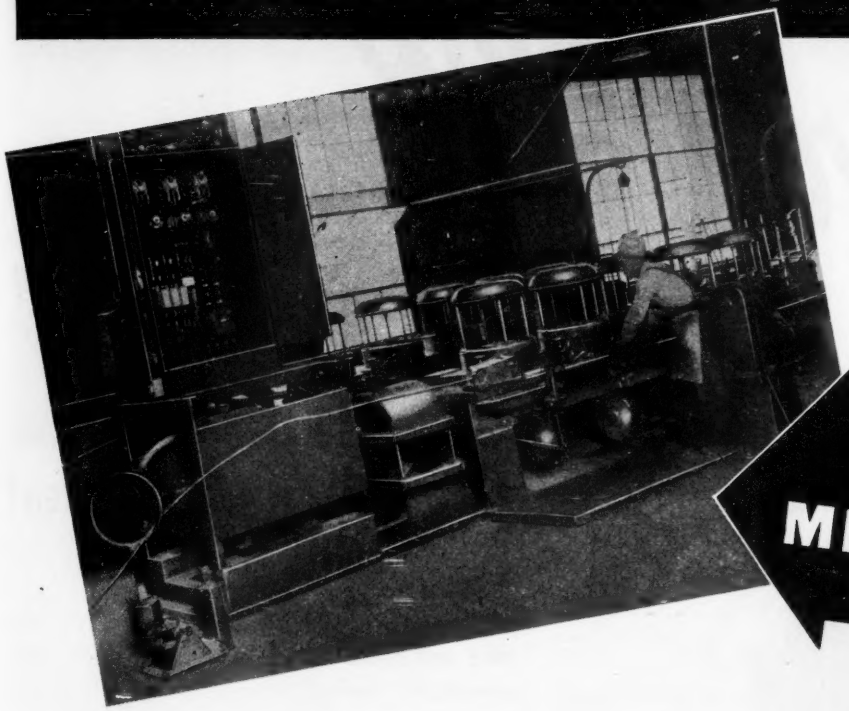
It's uniform, too, this bethanized coating—so uniform that there are no thin spots anywhere to invite rust. And, to meet exceptionally corrosive conditions, coatings can be applied up to three times the weight of those specified in conventional Type 3 galvanizing.

Put bethanized wire through its paces. Chances are you'll like it so much that you'll order it again and again. For full particulars, get in touch with the nearest Bethlehem district office, or Bethlehem Steel Company, Bethlehem, Pa.

★ Bethanized Wire ★ BETHLEHEM STEEL ★

WIRE & WIRE PRODUCTS, Vol. 21, No. 1, January, 1946, Executive Office, 300 Main St., Stamford, Conn. Published by the Quinn-Brown Publishing Corp., Richard E. Brown, President; R. S. Spengel, Sec. and Treas. Publication office, 206 Summer St., Stamford, Conn. Subscription price: U. S., $5.00; Canada, $5.00 per year, 50 cents per copy; Foreign, $7.50 per year. Entered as second class mail at the Post Office, Stamford, Conn., Feb. 9, 1945, under Act of March, 1879.

ELIMINATE THE BAKING OPERATION



with MAGNUS METAL COAT No. 267

FOR more than three years Magnus Metal Coat No. 267 has made unnecessary the use of lime in the production drawing of wire . . . thus eliminating the baking operation. This unusual material virtually ends rejects due to scratching or off-size, and gives a much better finished wire, particularly on bright wire, wire for metallic coatings or other subsequent finishes, welding wire, rope wire, tire bead wire, etc.

Magnus Metal Coat No. 267 is considerably superior in rust-proofing action to any other treatment. Hydrogen embrittlement is prevented right in the solution.

Die life is greatly improved, particularly on high speed operations using continuous machines. The cost of lubricants is reduced consistently . . . in many cases by as much as 50%.

These outstanding advantages of this new wire drawing coating deserve careful investigation. The cost of the material is obviously much more than that of lime, but when its economies are considered, the ultimate cost per ton of finished wire is a great deal less than that of wire drawn with lime.

A far from negligible additional result of using Magnus Metal Coat No. 267 is the cleanliness made possible on machines and surroundings . . . impossible when lime is used.

Write us for complete details.

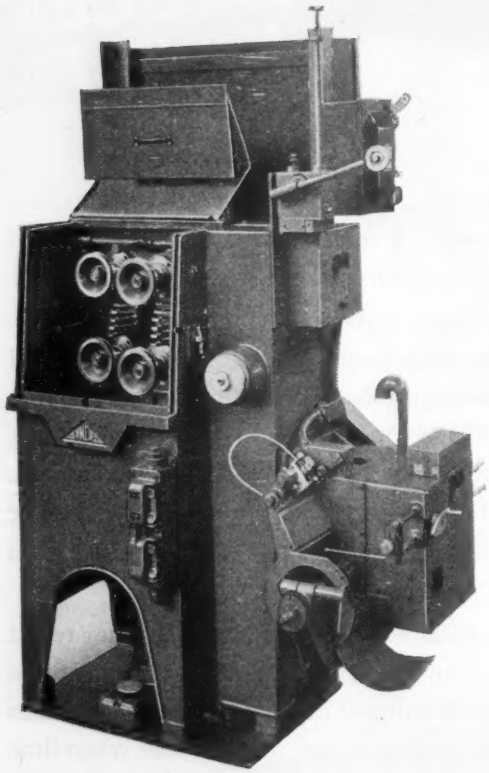
MAGNUS

MAGNUS CHEMICAL CO., 188 SOUTH AVE., GARWOOD, N. J.

Wire Drawing Compounds

Advanced DESIGN

A PROFIT BUIL DING FEATURE OF SYNCRO EQUIPMENT



The SYNCRO name on machinery for the wire and cable industry is synonymous with advanced design. For SYNCRO "visioneers" incorporate in their designs such obvious advancements as patented replaceable spring steel tire facings for drawing blocks—a housing that precludes any intermixing of solution with lubricating oil — a highly efficient system for cooling blocks and dies — higher coiler blocks that provide heavier coils. Also, the SYNCRO A.C. drive with simple change gears which economically provides drawing speeds at a 4 to 1 ratio, and the SYNCRO designed arrangement which permits drawing of split gauges. These are some of the features that account for the profitable performance of SYNCRO equipment in leading wire and cable mills throughout the world. Write for detailed information.

SYNCRO MACHINE COMPANY

113 SOUTH JEFFERSON STREET
CHICAGO 6, ILL.

REPRESENTED IN CANADA BY
CANADIAN ELEVATOR EQUIPMENT CO.
TORONTO

EXECUTIVE OFFICES AND GENERAL WORKS—611 SAYRE AVENUE, PERTH AMBOY, N. J.

Machinery for the Wire Industry

SYNCRO

meet the new CHAMP!

This new champion of lower heating costs already stands head and shoulders above the crowd, challenging the attention of every large scale producer of ferrous and nonferrous metal products requiring heat treatment. He is the embodiment of the F. E. I. Direct Fired System of Heat Treating, notably in Cover Annealing, Bright Annealing, Spheroidizing and Normalizing Furnaces for coiled strip; tin plate; flat sheets; wire; and rod. Wherever installed these furnaces have so far surpassed other equipment in quality and quantity of output, as to break all records for low unit cost.

Installation of complete new F. E. I. equipment, or F. E. I. modernization of your old cover annealing furnaces, are projects holding big possibilities in your postwar planning for increased production or lower cost.

OTHER F. E. I. PRODUCTS

Galvanizing Furnaces, for pipe, sheet and custom shops.

Galvanizing, Patenting, Lead Annealing and Salt Furnaces for the Wire Industry.

Ask for information, including service records on F. E. I. equipment in important iron and steel plants.

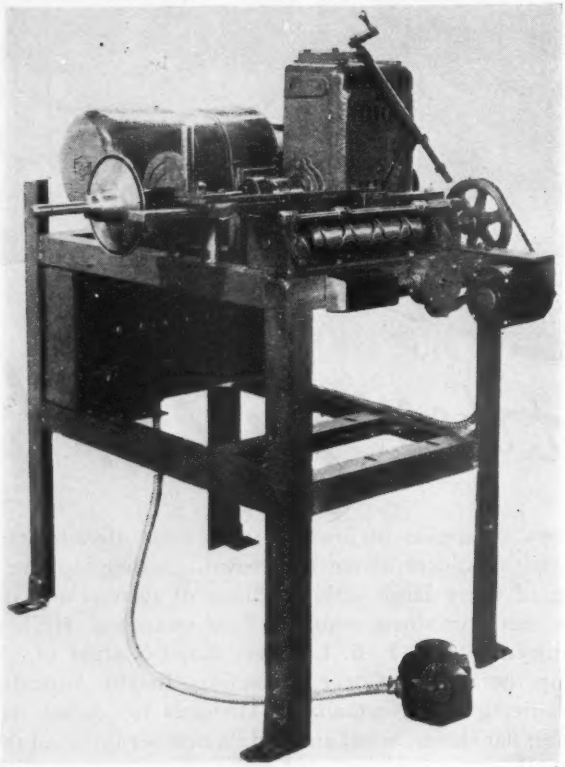
F.E.I.

FURNACE ENGINEERS, Inc.

Specializing in the design, manufacture and installation of furnaces for the metal working industries

1551 WEST LIBERTY AVENUE ★ PITTSBURGH, PA.

Motor Driven Variable Speed SPOOLER



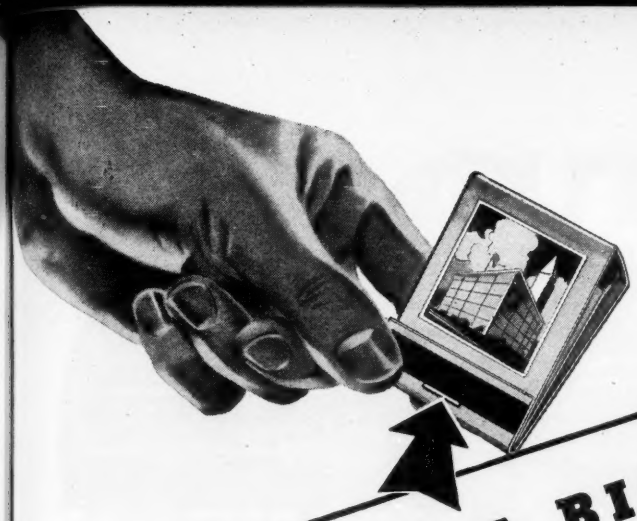
This machine is designed for spooling and non-returnable reels and spools. When equipped with the measuring machine and pre-determined counter, the machine will automatically stop at the required footage. Also, when used with the sparker, it will stop at a dielectric fault.

The motor is belt connected to a variable speed transmission with a 16 to 1 ratio. The main shaft of the spooler is direct connected to the transmission. There is an adjustable traverse electrically driven which runs at a constant speed. By varying the speed of the main shaft it is possible to layer-wind the wire on the spool. As there are no limit switches or electrical contactors in the motor circuit, the motor reverses instantaneously, making it possible to wind the wire level. The machine is completely equipped with electrical controls which start the motor with reduced torque, release the brakes and run the traverse motor.

Complete details may be had on request

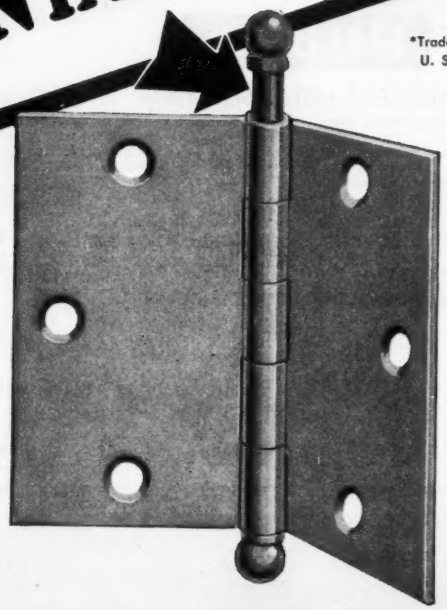
R. L. DAVIS ELECTRIC CO.

WALLINGFORD • CONNECTICUT



THERE'S A BIG DIFFERENCE IN SIZE . . . BUT BOTH ARE CONTINENTAL* WIRE

*Trademark registered U. S. Patent Office



THE WIRE OF A THOUSAND USES

The versatility of Continental wire is apparent when you look at the illustrations above. There is not only a big difference in the size of the wire in the match book and the pin in the door hinge, but there is a big difference in the temper, analysis, and finish. Continental wire for each of these applications is made especially to meet the individual requirements.

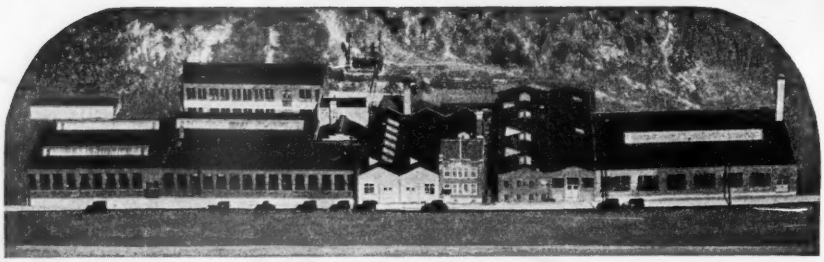
Continental specializes in producing wire in a vast variety of shapes, tempers, analyses, and coatings to fit the particular specifications of hundreds of products. You are invited to take advantage of this service. Write or wire today for complete information.

CONTINENTAL STEEL CORPORATION

GENERAL OFFICES • KOKOMO, INDIANA

PRODUCERS OF *Manufacturer's Wire* in many sizes, shapes, tempers and finishes, including Galvanized, KOKOTE, Flame-Sealed, Coppered, Tinned, Annealed, Liquor Finished, Bright, Lead Coated, and special wire. ALSO, Coated and Uncoated Steel Sheets, Nails, Continental Chain Link Fence, and other products.

HUDCO



HUDSON WIRE CO. PLANT AT OSSINING, N. Y.

This plant is one of the most up-to-date and completely equipped plants in the world for the production of "HUDCO" fine wires in all metals.

ESTABLISHED IN 1902

HUDCO

WIRES FOR METAL SPRAYING

Pure lead, Lead Alloy, Pure Zinc, Zinc Alloy, Copper, Tin, High Brass, Low Brass, Solder Wire, High Conductivity, Electric Wire. Cadmium, Nickel Silver, Aluminum, Monel Metal, Phosphor Bronze, Pure Nickel, Commercial Bronze, Brush Wires, Crimp and Straight, Brass, Steel, Nickel Silver, Copper and Prosphor Bronze.

HUDCO

FINE BARE WIRES

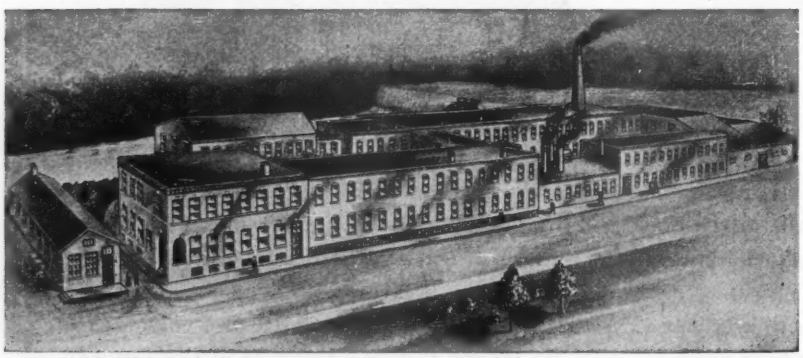
High Brass, Low Brass, Zinc 99.99+ and High Tensile Zinc, Commercial Bronze, Phosphor Bronze, Pure Tin, Lead, Antimonial Lead, Tinsel Lahns, Silver Plated Copper, False Gold and Copper. Cadmium, Nickel Silver, Silver Plated Copper, False Gold and Special Brass and Bronze Alloys to Specification, Metallic Fibre for Packing Purposes, Copper, Bronze, Zinc, Lead and Aluminum.

"HUDCO" specially processed Copper Wire for enamelling purposes is drawn from Selected Copper, insuring the maximum conductivity. This is but one example of the use of the most advanced and approved materials and methods in our processing.

BETTER WIRE AT LOWER COST

Send Us Your Specifications and Let Us Quote Prices

HUDSON WIRE COMPANY • OSSINING, N. Y.



WINCO

Winsted Division of HUDSON WIRE CO. at Winsted, Conn., modern and completely equiped enamelled wire plant for LEAKPROOF ENAMELLED WIRE and all standard and special coverings.

"WINCO" enamelled wire is drawn from special selected copper, assuring perfect enamelling. All wire tested before shipment.

"WINCO" enamelled wire is available in all standard and special coverings made to meet exacting requirements.

Samples of LEAKPROOF and other enamelled wires sent on request

WINSTED DIVISION OF HUDSON WIRE COMPANY

WINSTED, CONN.

GOVERNMENT SURPLUS STEEL

AVAILABLE NOW THROUGH RFC

Liberal Price Reductions

This is an unusual opportunity for many manufacturers to get ahead in their reconversion program. While some of the sizes, shapes and alloys of the RFC stock of surplus steel may differ from the specifications of normal industry requirements, it has the advantage of being quickly available.

Attractive allowances have been made in our pricing program to move this steel into the hands of private industry.

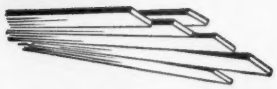
HOT ROLLED PLATES

Carbon and Alloy. Wide range of sizes from ¼" to 6" thick, up to 96" wide.

TOOL STEEL

7,000 tons. In Water-hardening, Oil-hardening and High Speed grades. Large range of bar sizes.

STRIP STEEL



Available in Hot Rolled and Cold Rolled, Carbon and Alloy. Large quantity of High Carbon Cold Rolled Strip—to be sold at low Carbon prices—or lower. Large range of sizes.

BAR STEEL

Hot Rolled and Cold Finished in both Carbon and Alloy. Rounds, squares, flats and hexagons in various specifications. Many items in large quantities.

Write, wire or phone your requests to the nearest RFC agency listed below for more detailed information. If you desire, credit terms can be arranged. If your local office does not have all the materials you need, it will endeavor to locate them from other offices throughout the country.

CHECK THIS LIST

Miscellaneous STEEL PRODUCTS

1. Carbon and Alloy Billets, Blooms, Slabs, Skelp, Rods, etc. . . . ☐
2. Reinforcing Bars . . . . . ☐
3. Structural Steel Shapes . . . ☐
4. H. R. & C. R. Sheets, Strip Steel, Carbon and Alloy . . . . . ☐
5. Plates—Tin Plate, Terne Plate, Black Plate . . . . . ☐
6. Wire and Wire Products, Carbon and Alloy, Wire Rope, Reinforcing Wire Mesh . . . . . ☐
7. Stainless Steel Sheets, Strips, Standard Types . . . . . ☐
8. Iron and Steel Pipe, and Tubing—Valves and Fittings . . . . ☐
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Name.....

Firm.....

Address.....

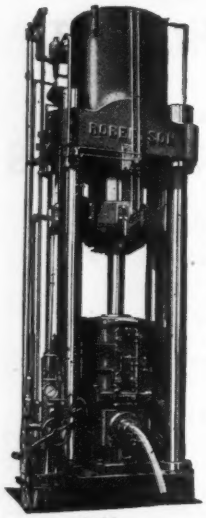
RECONSTRUCTION FINANCE CORPORATION

A Disposal Agency Designated by the Surplus Property Administration

Agencies located at: Atlanta • Birmingham • Boston • Charlotte • Chicago • Cleveland • Dallas • Denver Detroit • Helena • Houston • Jacksonville • Kansas City, Mo. • Little Rock • Los Angeles • Louisville Minneapolis • Nashville • New Orleans • New York • Oklahoma City • Omaha • Philadelphia Portland, Ore. • Richmond • St. Louis • Salt Lake City • San Antonio • San Francisco • Seattle • Spokane

157-1

PURPOSELY Made for a SPECIFIC PURPOSE

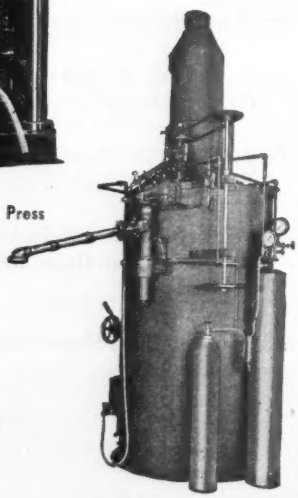


Cable
Lead-Encasing Press

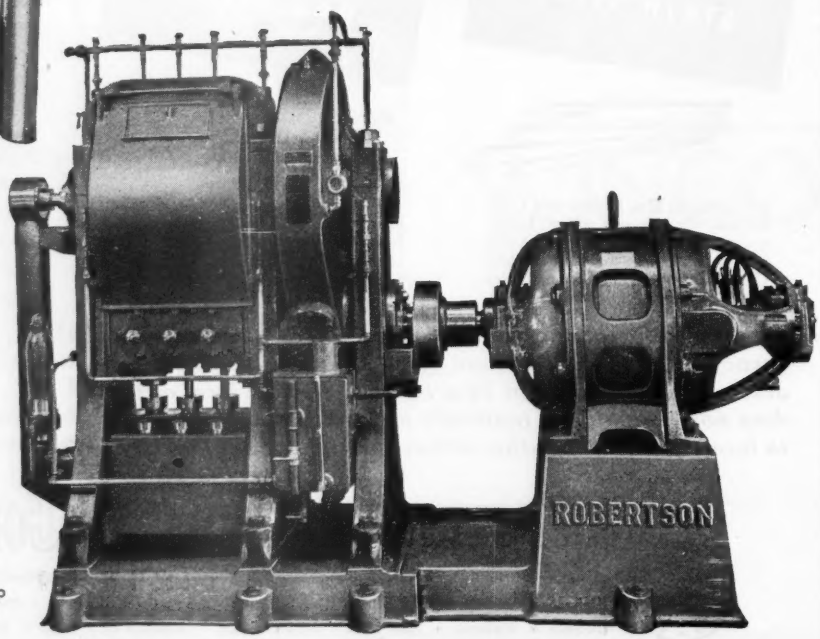
Keeping in mind the particular job for which it is required, the men who make Robertson hydraulic equipment produce machinery that is practically "tailor-made." Painstaking work, compounded of long-time skill and craftsmanship, goes into every part. That is the reason for the greater satisfaction to be obtained from Robertson machinery.

And all these are reasons for Robertson's continued popularity and leadership over a period of 87 years.

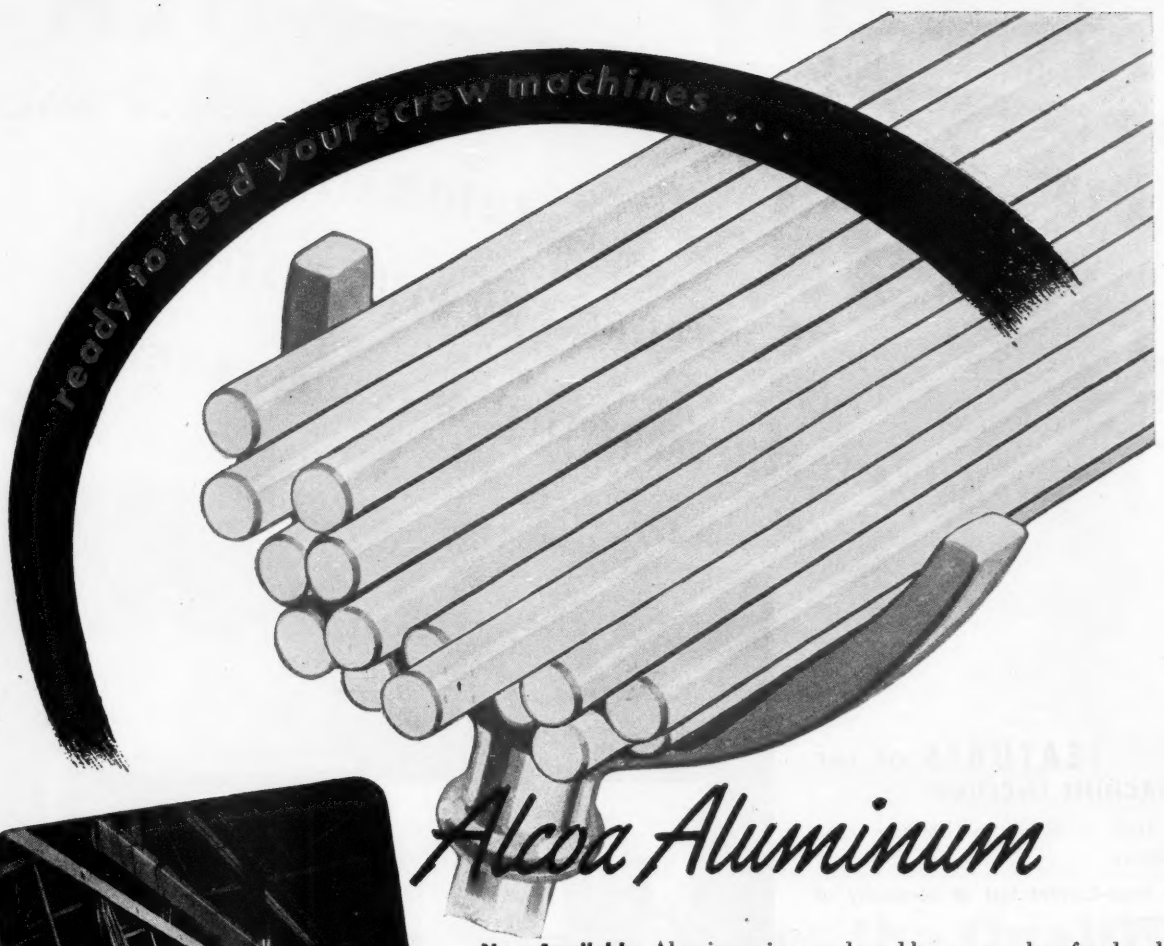
JOHN Robertson
COMPANY INCORPORATED
125-135 WATER STREET, BROOKLYN 1, NEW YORK
Designers and Builders of all Types of Lead Encasing Machinery
Since 1858



Closed Lead
Melting Pot



High Pressure
Hydraulic Pump



Alcoa Aluminum

Now Available. Aluminum in rounds and hexagons; chamfered and ready to go to work in your screw machines. Alcoa's distributors maintain large stocks of standard sizes for your convenience.

You Pay 22.2% Less Today. The base price of 1-inch diameter Screw Machine Stock (Alcoa Alloys 11S-T3 and 17S-T) is 7 cents less per pound than in September 1939, a 22.2% reduction. Other Alcoa Aluminum Screw Machine Stock prices have dropped correspondingly—same high quality, same careful preparation of stock, same advantages.

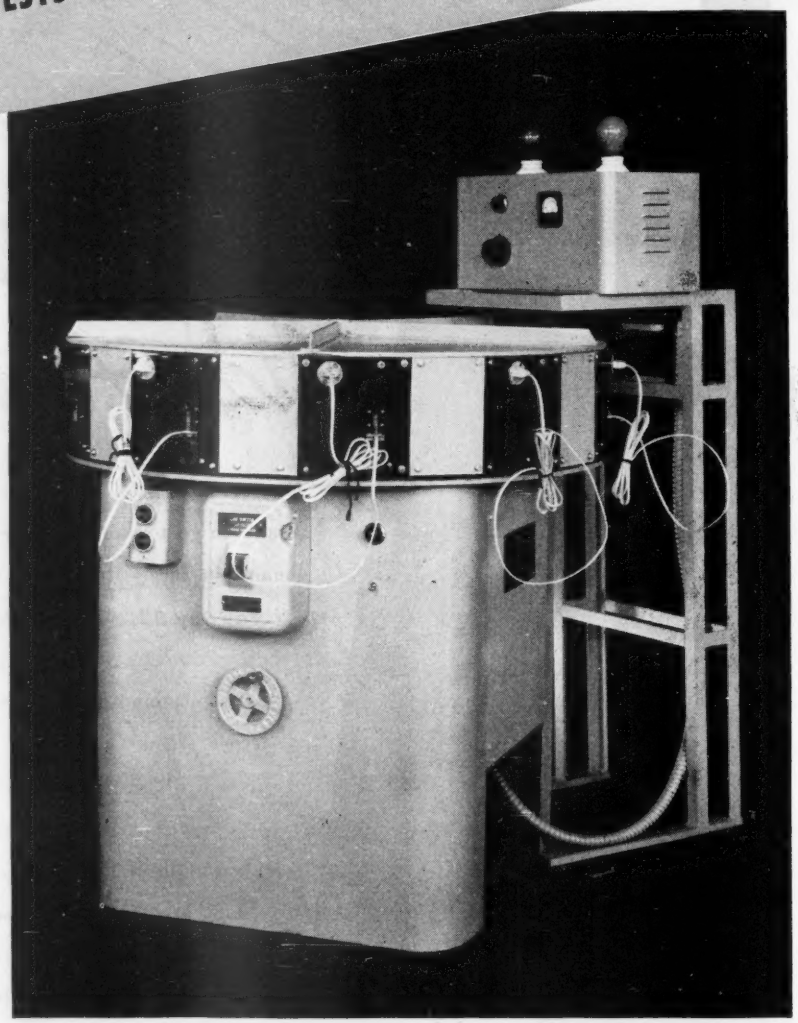
Should you need help getting a job going, Alcoa's servicemen are ready to advise you. For this help, call our nearest office, or write ALUMINUM COMPANY OF AMERICA, 1828 Gulf Building, Pittsburgh 19, Pennsylvania.

ALCOA FIRST IN **ALUMINUM**

ALCOA ALUMINUM

THE JLE AUTOMATIC CORD AND PLUG TESTER

AUTOMATICALLY TESTS MANY TYPES OF CORD ASSEMBLIES



FEATURES OF THE MACHINE INCLUDE:

1 High potential test between conductors.

2 High-Current test of continuity of copper.

3 Automatically rejects cords that fail.

4 Those cords that fail on high-potential and those that fail on continuity test are rejected separately.

5 Cord sets which pass both tests are automatically ejected at a third point.

6 Cord receptacle panels are easily removable and interchangeable to allow testing of various types of cord assemblies.

7 Machine capacity ranges from 1,200 to 3,600 cord sets per hour, depending on the type of cord assembly.

8 Speed of the rotating top assembly is variable in a 3 to 1 ratio.

Complete technical information and specifications are available. Ask for them.

JAMES L. ENTWISTLE CO.

43 CHURCH ST., PAWTUCKET, R. I.

WORLD'S LEADING MANUFACTURER OF SPARK-TESTING EQUIPMENT

AJAX

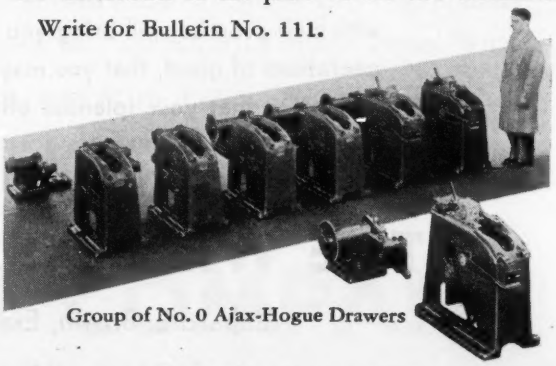
Hogue Wire Drawer

An Attachment which Improves the Quality and Lowers the Cost of Cold Heading

This attachment for any make of Cold Header lowers production costs and improves the quality and accuracy of the finished products. By providing freshly drawn and coated, clean, straight, accurate wire for the header dies, a high degree of uniformity is attained. The lower yield point of the freshly drawn wire allows the metal to flow more freely, filling out the die impressions. This makes heading easier, with considerably less wear on the dies.

The Ajax-Hogue Drawers are built in five sizes for wire diameters of ¼ to ¾ inch. Hot rolled stock is used instead of cold drawn wire, with the saving of the differential in the price of the two materials.

Write for Bulletin No. 111.



Group of No. 0 Ajax-Hogue Drawers

THE AJAX MANUFACTURING COMPANY
EUCLID BRANCH P. O. CLEVELAND 17, OHIO
110 S. DEARBORN ST. • CHICAGO 3, ILLINOIS

The Directors and Officers of the WIRE ASSOCIATION

Extend to each and every member of the Wire Association their cordial hope that 1946 may bring to you a full measure of prosperity and satisfaction in your work and in your personal affairs.

They extend to you and the Companies you represent the further hope, in this year of Peace, that the many problems that becloud our industrial horizon, may be worked out in such manner that harmony may again prevail in this free land of ours, for which your sons and, indeed, many of you yourselves, have made such notable sacrifices in order that our American way of life might continue to flourish.

You have also fought mightily to win the war on the home front and it is to be hoped that the New Year, so fraught with high promise, will bring you all a fulfilment of those expectations of good, that you may conclude this year with the realization that your splendid efforts have not been in vain.

THE WIRE ASSOCIATION

Richard E. Brown, Executive Secretary

300 MAIN STREET STAMFORD, CONN.

"Steelskin Brands"

Reg. U. S. Pat. Office

WIRE, TUBING, STAMPING
DEEP DRAWING SOAPS AND COMPOUNDS

✦ ✦ ✦

SPECIAL DRY AND WET WIRE DRAWING SOAPS AND COMPOUNDS FOR

High Carbon	Tool Steel
Low Carbon	Spring Wire
Copper	Coat Hanger Wire
Brass & Bronze	Stainless Steel

And Many Other Types of Wire.

ALSO SPECIAL PRODUCTS TO REMOVE ACID SMUT ✦ ✦ ✦ ELIMINATE LIME

Back of the "STEELSKIN" TRADE MARK is a Thirty-Five Year Period of Experience in the Development and Manufacture of *Soaps and Compounds* for Dry and Wet Drawing of all Types of Ferrous and NonFerrous Wire.

Our Engineers Will Be Glad to Co-operate With You in Finding the Most Economical and Efficient Solution to Your Drawing Problems.

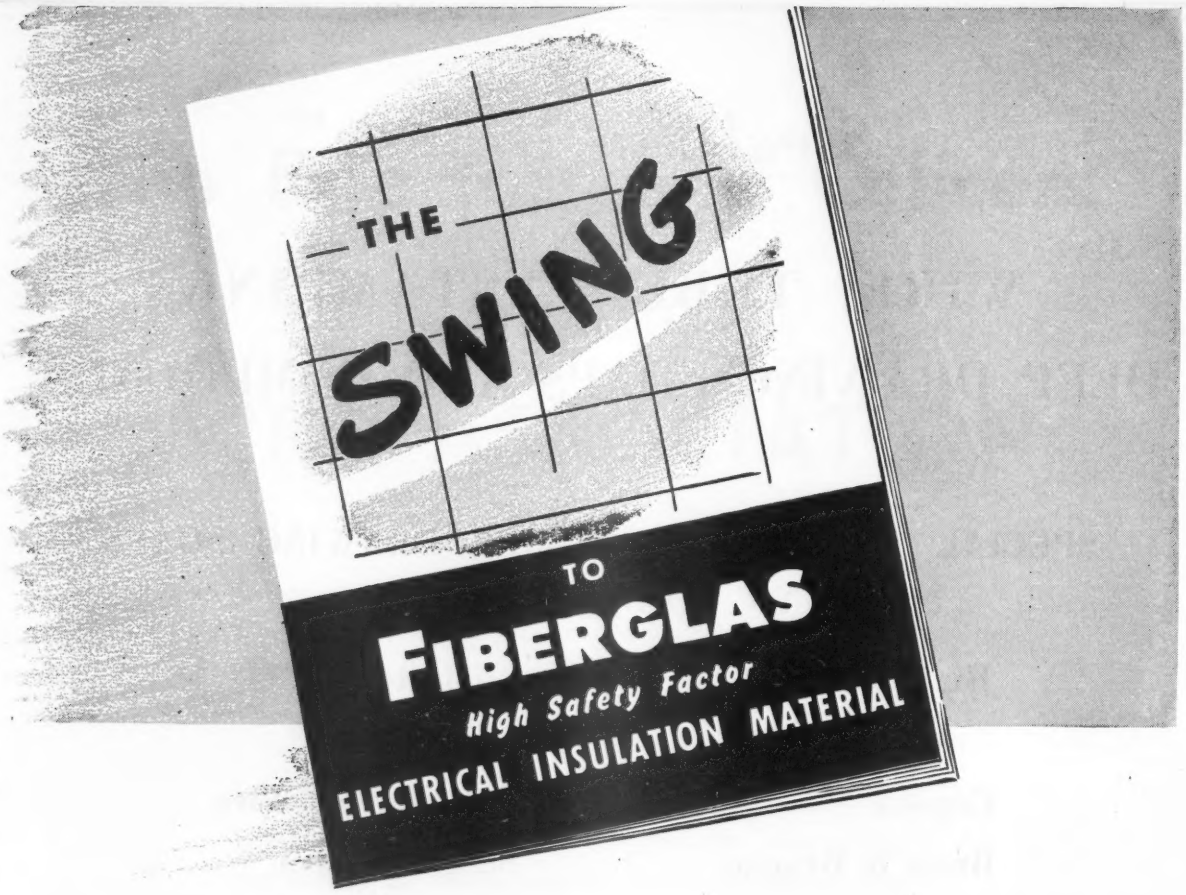
Write or Telephone

R. H. MILLER COMPANY

HOMER, NEW YORK

Established 35 Years

Tel. No. Homer 192



What does a GROWING PREFERENCE mean to you?

The growing preference of designers, engineers, manufacturers and users for Fiberglas* Electrical Insulation Materials means bigger profit opportunities for wire and cable companies.

The "Swing to Fiberglas" started before the war, was accelerated by the war and continues to gain momentum. Today, there are more people specifying and buying Fiberglas Electrical Insulation Materials than ever before. It's the trend and it pays to back a winner.

The new, bigger, stronger Fiberglas sales promotion and advertising campaign for 1946 is all ready to go. It will support the advertising and sales activities of the many wire companies featuring Fiberglas Insulated Wire.

Why not cash in on the "Swing to Fiberglas"? If you don't already have details of the 1946 advertising program, write *Owens-Corning Fiberglas Corporation, 1875 Nicholas Building, Toledo 1, Ohio.*

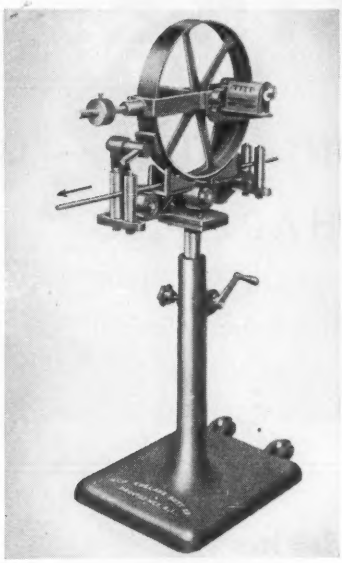
In Canada, Fiberglas Canada Ltd., Oshawa, Ontario.

FIBERGLAS ELECTRICAL INSULATION MATERIAL

*T. M. Reg. U. S. Pat. Off.

WIRE MEASURING MACHINES

STYLE A



STYLE B

MEASURING MACHINES as illustrated above are built in two sizes, and can be furnished either with counter on the right-hand side, Style "A", or with counter on the left-hand side, Style "B".

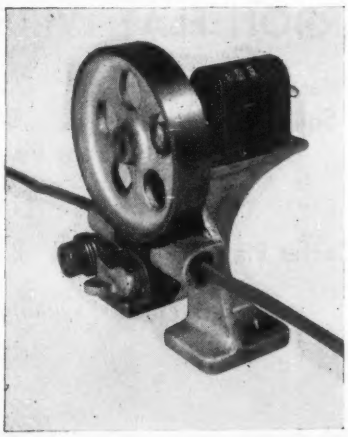
THE COUNTER has plain distinct figures, can easily be set back to zero, and measures up to 100,000 feet.

THE STANDARD, which is an optional feature, has rollers on its base to facilitate moving the machine about. Adjustment of machine to proper height is attained by means of a rack and pinion in this standard.

No. 1 Size — 30" circumference wheel
No. 2 Size — 50" circumference wheel

THE BENCH TYPE of MEASURING MACHINE is made to measure insulated or bare wire, or any flexible material not over 5/16" diameter.

This machine is equipped with a three-figure reset counter.



SMALL BENCH TYPE

Write for details

NEW ENGLAND BUTT COMPANY

ESTABLISHED 1842

304 PEARL STREET
PROVIDENCE 7, RHODE ISLAND, U. S. A.
James Day (Machinery) Ltd., "Ford House," 88 Regent St., London., W.I., England

WIRE for Practically All Purposes and Requirements

IRON – STEEL – LOW CARBON – HIGH CARBON

SHAPES

Square - Keystone - Flat
Round - Half Round - Special
Shapes - Straightened
and Cut

Tempered and Untempered

FINISHES

Liquor Finish - Bright
Galvanized - Coppered
Enameled All Colors
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Oil Tempered

FOR

Belt Hooks
Binding - Bonnets
Bookbinders
Brooms - Brushes
Clips - Cotter Pins
Florist - Glass Wire

Grape Tying
Hair Pins
Hook and Eyes
Link Fabrics
Lock Washers

Mattresses
Pins
Special Springs
Ropes - Stapling
Stone Wire
Tags - Weaving

• FLY SCREEN WIRE CLOTH • GALVANIZED HARDWARE CLOTH •

HIGH CARBON FLAT WIRE TEMPERED AND UNTEMPERED

Gutter Broom
Square

Curtain Spring
Snap Spring
Bobby Pin — Flat & Half-round

Lock Spring
Fish Tape

LOW CARBON

Cotter Pin

Box Stitching

Bookbinders

Highest Quality and Service Guaranteed

Established 1905

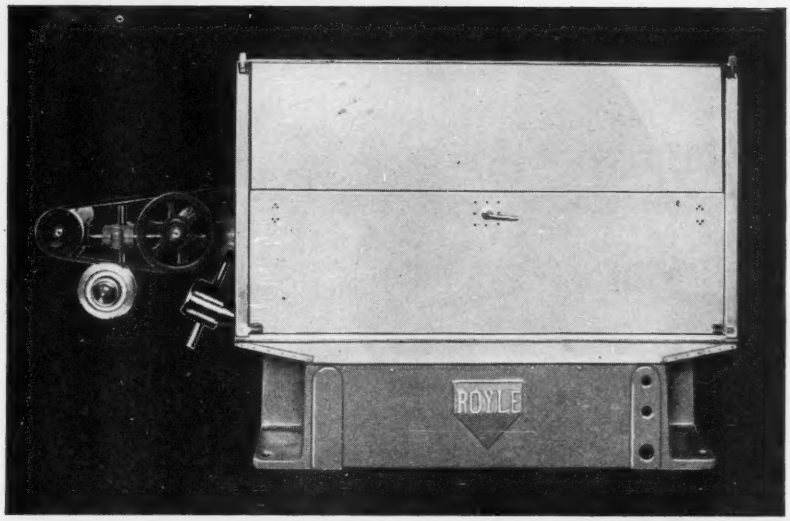
The Seneca Wire & Mfg. Company

Fostoria, Ohio

Representatives and Warehouses in principal cities

THE ROYLE 36"

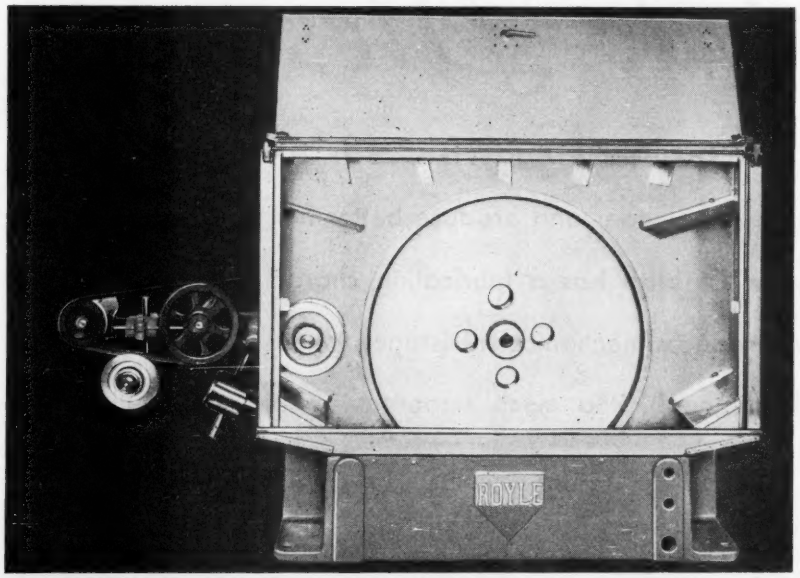
HIGH SPEED CAPSTAN FOR RESIN INSULATED WIRE



CHECK THESE FEATURES

- Stainless steel watertight enclosure
- Total enclosure permits higher wire speeds
- More efficient wire puller stabilizes wire speed
- Secondary idler pulleys guide wire across capstan preventing rubbing and permitting greater quantities of wire to be cooled simultaneously
- Quiet running
- All bearings are located outside of enclosure to prevent contact with water
- Built-in air wiper
- Full size folding side assures maximum accessibility
- All interior surfaces which are touched by wire or spray are of aluminum or corrosion resisting metal to withstand the chemical reaction of the various resins

Write for Complete Details



JOHN ROYLE & SONS

ROYLE PATERSON N. J. 1880

ARMY E NAVY

PIONEERED THE CONTINUOUS EXTRUSION PROCESS IN

James Day (Machinery) Ltd.
London, England
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Home Office
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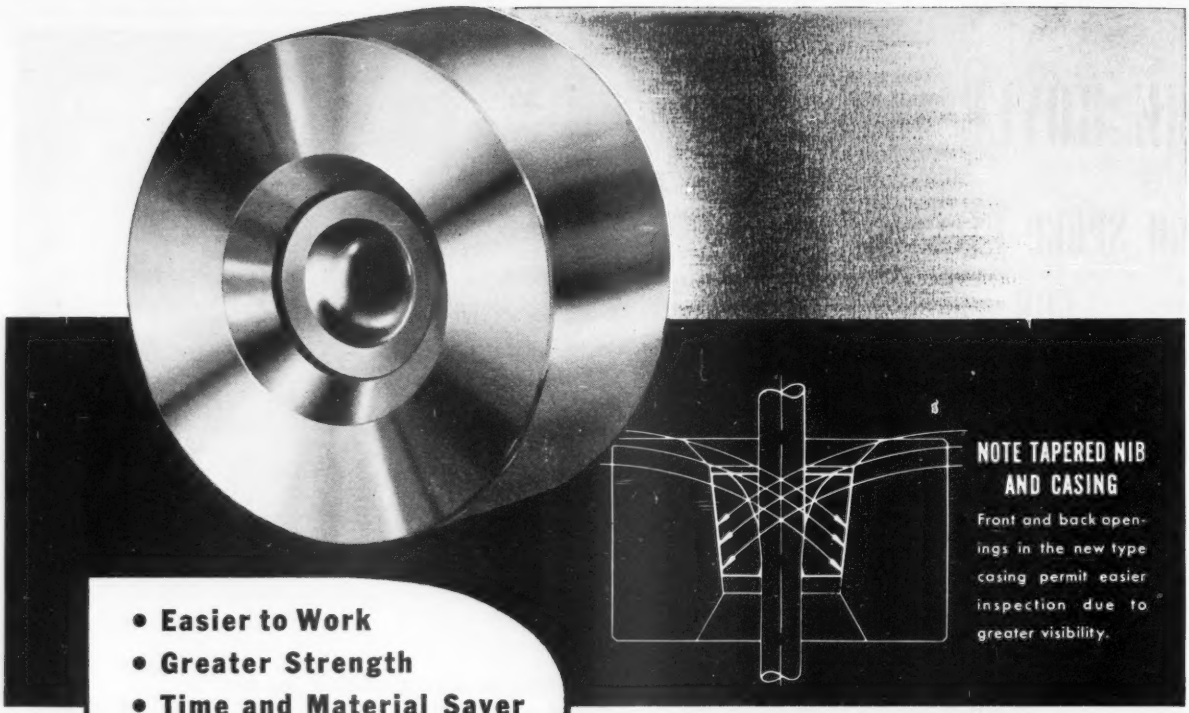
SHerwood 2-8262

Akron, Ohio
J. C. Clinefelter
UNiversity 3726

PATERSON 3, NEW JERSEY


NOTE TAPERED NIB AND CASING
Front and back openings in the new type casing permit easier inspection due to greater visibility.

- Easier to Work
- Greater Strength
- Time and Material Saver
- Better Lubrication
- Full Visibility

VASCOLOY-RAMET

Tantalum/Tungsten

Carbide Dies . . .

A BOOK ON STANDARD ROUND HOLE DIES just off the press will be helpful to you. Write us for Bulletin VR348.

. . . for Drawing Wire, Bar and Rod

Maintain size longer and produce better finish. Tantalum/Tungsten Carbide has a lubricating characteristic which greatly reduces mechanical resistance in drawing, and in so doing, enables a much smoother finish. Many mills report longer productive life, less down time, greater tonnage per die and greater operator satisfaction.

4533

VASCOLOY RAMET CORPORATION

An Affiliate of Fansteel Metallurgical Corporation and Vanadium Alloys Steel Company

NORTH CHICAGO, ILLINOIS • SALES AND SERVICE IN PRINCIPAL CITIES

. . . Helps the Navy to **SEE** the target
(IN RADAR)

. . . Helps the Navy to **HIT** the target
(IN FIRE CONTROL)

The two types of shipboard cable, TTRS *(above)* and TTRSA *(below)*, are identical in construction except for the armor braid covering the latter. Inside the sheath is a cabled assembly of twisted pairs; each twisted pair consists of tinned copper conductors insulated with Du Pont polythene, then twisted into duplex pairs, which are covered with tinned copper shielding braid and with color-coded cotton braid. The individual conductors are size AWG 20 and consist of 7 strands of 0.0126-inch tinned copper. The polythene insulation is extruded to a thickness of 20 mils.

Shipboard cable insulated with Du Pont POLYTHENE

The shipboard cables here illustrated furnish another striking example in the growing list of difficult insulation jobs done capably by Du Pont's versatile plastic, polythene. These cables, manufactured by Rockbestos Products Corporation of New Haven, Conn., are used by the Navy for three functions: for transmission of synchronizing voltages in fire control equipment, for indicator sweep voltages, and for video frequency receiver output signals. In use they transmit signals from circuit to circuit as in a telephone circuit.

Polythene offers outstanding advantages as an electrical insulation. Because of its high dielectric strength, only a minimum thickness is needed. Polythene's low power factor makes it exceptionally effective for high-frequency wire, such as is used extensively in television. Polythene is chemically inert, light in weight (specific gravity 0.92) and retains its toughness and flexibility at temperatures ranging from −50° F. to 200° F.

For complete data sheet on polythene, write E. I. du Pont de Nemours & Co. (Inc.), Plastics Dept., Arlington, N. J.

DU PONT
REG. U. S. PAT. OFF.

FOR *PLASTICS..* CONSULT *DU PONT*

BETTER THINGS FOR BETTER LIVING
. . . THROUGH CHEMISTRY

An Open Letter To Contributors

Dear Sirs:

To you who have contributed technical articles and papers on subjects relating to wire and wire product making during the past year, goes the commendation and thanks of our entire industry.

Through your unselfish efforts and painstaking work, you have brought to our field through the editorial pages of WIRE AND WIRE PRODUCTS a vast fund of information that has enabled others to make technological improvements in production processes and techniques. You have contributed to the winning of the war. Your unstinted "giving" has set a standard that may well serve as a pattern for the further dissemination of knowledge in this New Year. You have cast your bread upon the waters, and we hope and believe that your generosity will not have gone out without having returned something in kind to you.

The war is over! Many new developments which have arisen out of the war years still remain to be appraised, written about, discussed. With some of the terrific pressure of the war era eased, we take this occasion to ask you to give thought to the preparation of articles on such subjects as may be of further benefit to our industry, and give freely this year of your knowledge and experience, that our field may continue to expand and improve.

To the many who have not written for publication, but who have developed a fund of new information on processes, machinery, equipment, supplies and products, we here extend a cordial invitation to submit articles that may be of interest and value to others.

Let us all work together in this New Year of 1946, the first full year of Peace, to set new standards of mutual service, by which our field may continue to prosper and grow.

For your past cooperation, and for that which we anticipate, the publishers of WIRE AND WIRE PRODUCTS express their cordial and heartfelt thanks.

A Happy and Prosperous New Year to you all!

Yours sincerely,

WIRE AND WIRE PRODUCTS

Richard E. Brown, Editor

All right—so YOU don't make mousetraps!

Not everybody makes mousetraps . . . but whatever your business—there's a nice feeling about having customers beat a path to your door. And if your product requires the use of top-quality wire, experts Wick and Spen can help you.

In fact one thing that makes us happy is the well-beaten path to *our* door—made by manufacturers who come, first with questions and then with repeat orders. Here is how we go about meeting your requirements.

First our metallurgists determine the amount of processing the wire must undergo and the ultimate service requirements of the product. Then they establish the carbon content, annealing, cleaning, finishing procedures and laboratory control tests. As a further assurance of quality we make and process our own steel in our own open hearths and modern wire mills.

For 125 years we've been making high and low carbon steel wire, round and shaped, in a wide variety of sizes, tempers, grades and finishes. The well-beaten path to our door is evidence of the confidence our customers have in products bearing the Wickwire Spencer label, and your assurance of satisfactory service.

Send your wire questions to

WICKWIRE SPENCER Steel

A DIVISION OF THE COLORADO FUEL AND IRON CORPORATION
EXECUTIVE OFFICES—500 FIFTH AVENUE, NEW YORK 18, N. Y.
Abilene (Tex.) • Boston • Buffalo • Chattanooga • Chicago • Clinton (Mass.)
Detroit • Houston • Los Angeles • Philadelphia • San Francisco • Tulsa • Worcester

One Of Wire Rope's Toughest Jobs!

THIS huge earth mover, known as a walking dragline, operating in a coal strip-mine, scoops up 6 tons of earth at every swing, each 50 to 60 seconds, day in and day out. Its efficiency---in fact, its ability to perform continuously month after month, year upon year---depends largely on a few strands of wire rope. ***This is one of the toughest jobs which wire rope is called upon to perform.***

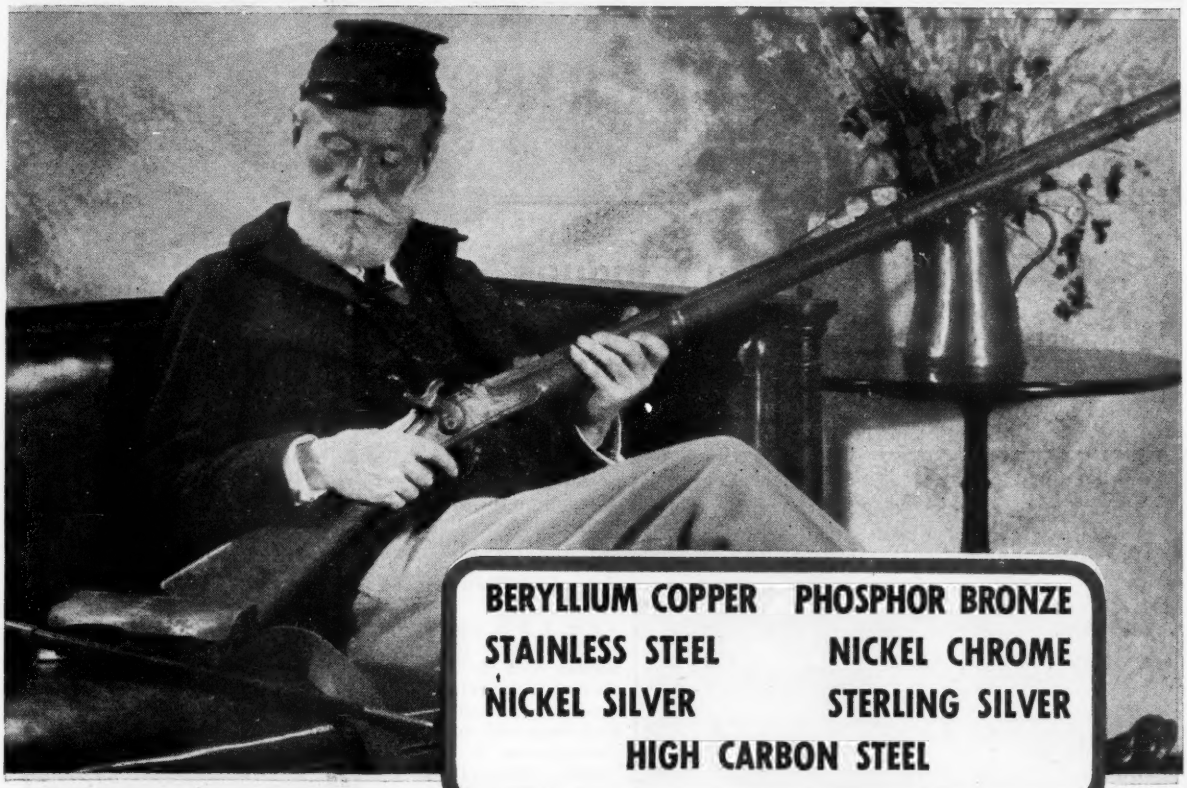
Through these cables is transmitted all the power of a 400 horsepower Diesel engine, to swing a 160 foot steel boom and a truck size drag bucket. The wire from which this cable is made must be tough and strong---must resist abrasion---must be uniform in gauge and possess flexibility and other positive characteristics. These are the salient reasons why these cables are made from Youngstown's Yolectro High Carbon Rope Wire.

Like all its wire mill products, the wire supplied by Youngstown to wire rope manufacturers is of finest quality steel, refined, rolled and drawn to exact specifications. Youngstown wire can be furnished now to your specifications. Write, wire or phone our nearest branch.

YOUNGSTOWN
THE YOUNGSTOWN SHEET AND TUBE COMPANY
YOUNGSTOWN 1, OHIO
Export Office . . . 500 Fifth Ave., New York
Manufacturers of
CARBON · ALLOY AND YOLOY STEELS

QUALITY · YOUNGSTOWN · SERVICE

Wire - Nails - Bars - Rods - Sheets - Plates - Conduit - Pipe and Tubular Products - Electrolytic Tin Plate - Coke Tin Plate-Tie Plates and Spikes.



Grandpa did all right . . . in '63!

Muzzle-loaders, like crudely drawn wires, were acceptable in the old days. Now, however, the stringent requirements of modern products and modern engineers demand that perfection be built into every hank, coil and spool of wire. The Spencer engineering department is staffed with capable men to produce quality steel and alloy wire of exacting standards in all fine sizes. Write Dept. WP-15 for engineering information on your fine wire requirements.

SPENCER WIRE

"SPECIFY SPENCER" for *exact* specifications

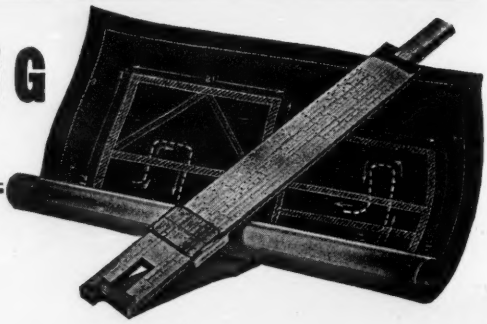
★★★★

SPENCER WIRE COMPANY

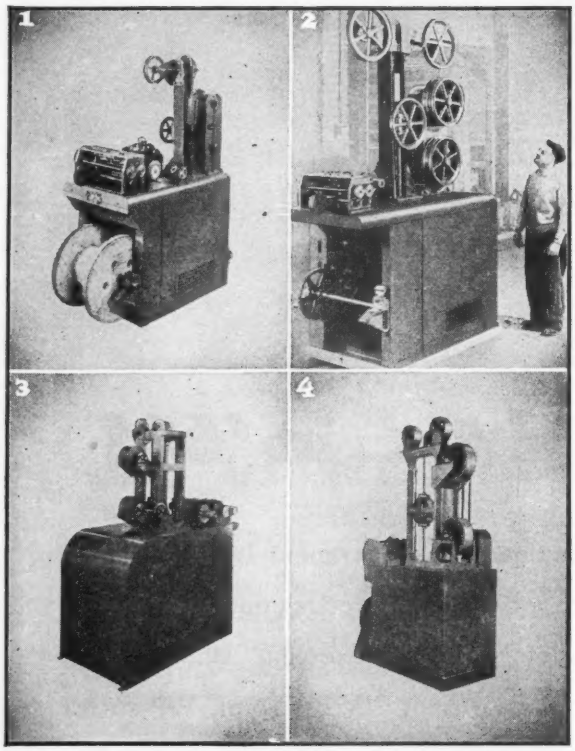
WEST BROOKFIELD PLANT

WEST BROOKFIELD - MASS.

OVEN ENGINEERING NEWS



IOE Constant-Tension Windups Now Available for Wide Range of Processing Applications



THE coating, impregnating and drying of continuous materials, such as insulated wire, cable, tape, yarn, fabrics and cords, is a task which demands top engineering and machine design skill. One of the most important factors in any coating systems is the windup machine, providing the motive power to draw materials through coatings, saturants and drying tower. All IOE windups, such as those shown left, are built on the same basic design, yet that design is flexible enough to suit a variety of applications.

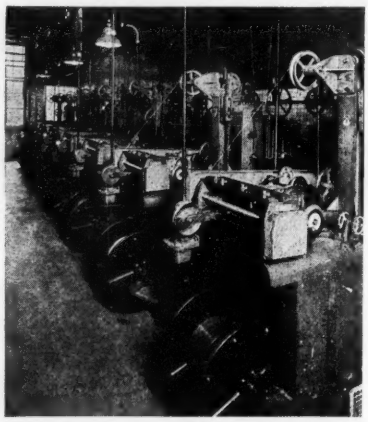
Fig. 1, left, shows a high-speed, low-tension unit for lacquering, saturating, waxing, respooling and mono-filament impregnation. It will handle materials from .010" to .385" diameter at speeds up to 1500 feet per minute.

The large machine in Fig. 2 is a heavy-duty extrusion take-up for large diameter cable running at low speeds and high tensions. It handles flexible materials up to 1.50" diameter at speeds from 25 to 240 feet per minute, with tensions as high as 500 pounds.

The saturating takeup in Fig. 3 is designed for medium speeds and tensions. This machine handles material up to .750" diameter at tensions up to 100 pounds and speeds from 80 to 480 feet per minute.

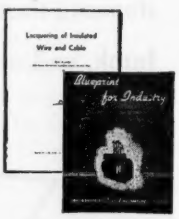
Flat materials such as tape and textiles are handled by the machine in Fig. 4. This particular model is designed for materials up to 6" wide and .060" thick, though wider rolls are available. Tension is adjustable over a wide range, and the speed change ratio is 10 to 1.

All machines are available with hydraulic, electric or electronic synchronization, and with traversing mechanisms for wide lay range adjustment. Multiple units handling up to 12 ends simultaneously also are supplied by this company, a good example being the eight-end system shown below, in operation at the Lenz Electric Company of Chicago.



FREE BULLETINS

You may obtain, without charge, full data on windup machines and complete coating systems for continuous materials. Just drop us a line.



(This is No. 21 of a series. Reprints of previous advertisements will be sent free upon request)

IOE ENGINEERING VERSATILITY

THE INDUSTRIAL *Oven Engineering* COMPANY

13825 TRISKETT ROAD, CLEVELAND 11, OHIO

Engineering Representatives in Principal Industrial Areas

★ ASSOCIATED COMPANY: JAMES DAY MACHINERY LTD., LONDON, W. 1, ENGLAND ★

Talide
(TUNGSTEN CARBIDE)

Performance!

Talide Out-Performs Steel Die 25 to 1 on 5" Alloy Steel Tubing

Here's a recent production report from one of America's largest mills.

Using a Talide Die instead of a steel die on a cold drawbench, this concern produced 252,000 feet of 5" alloy steel tubing, as compared with the normal run of 10,000 feet with a steel die . . . a production advantage of 25 to 1.

This performance is not phenomenal with Talide. Made from the hardest metal known, Talide Dies stay on the job many times longer than any high speed steel. "Down time" practically disappears, enabling you to establish and maintain profitable continuous production. Scrap and rejections offer no problem because Talide Metal eliminates pickup, scoring and scratching. Equally important, with such products as tubing, these mirror-like dies impart a much higher finish.

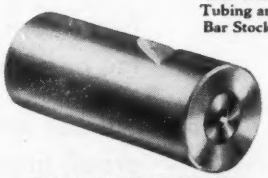
Talide Metal is a real cost-cutter. Write for Bulletin No. 43-WP or ask one of our Talide engineers to stop in and show you how you can produce more for less with Talide Metal.

TALIDE METAL
MEETS EVERY REQUIREMENT

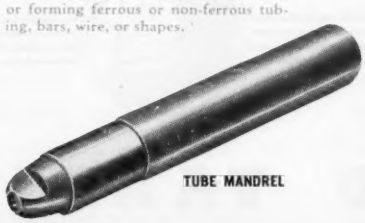
Metal Carbides, a pioneer in the carbide industry, makes Talide Dies in all sizes from pin-point up to 24" I. D. Used successfully in all types of manufacturing and fabricating plants for cold drawing or forming ferrous or non-ferrous tubing, bars, wire, or shapes.

SHEET METAL DIES
(For Deep Drawing Metal Products)

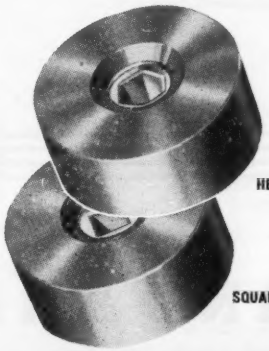
DRAWING DIES
(For Wire, Tubing and Bar Stock)



HEADING AND EXTRUSION DIES
(For Shaping and Sizing Bolts, Nuts, Screws, and Rivets)



TUBE MANDREL



HEXAGON DIE

SQUARE DIE

THE ENGINEERED CARBIDE FOR ALL APPLICATIONS

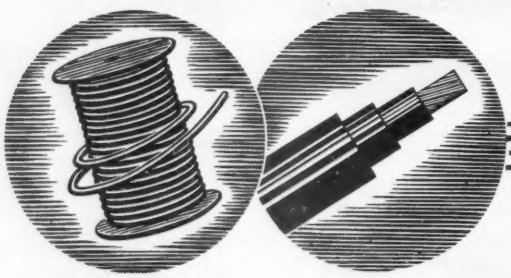
METAL CARBIDES CORPORATION

YOUNGSTOWN 5, OHIO *Pioneers in Tungsten Carbide Metallurgy*

SINTERED CARBIDES FOR CUTTING • HOT PRESSED CARBIDES FOR DRAWING AND WEAR RESISTANCE

SPECIALIZED RESEARCH EXPERIENCE

In Insulating Wire Finishes



You are invited to attend a meeting of minds between your engineering staff and ours. The experience of our technical staff embraces all types of insulating finishes to meet the most exacting requirements.

Every formulation is engineered to individual specifications for the particular service required.

Special emphasis should be directed to our non-toxic, flame proof, impregnating compounds and solutions. Also to all types of wire and cable lacquer coatings.

STANDARD VARNISH WORKS

Engineers of Product Finishes

NEW YORK - CHICAGO

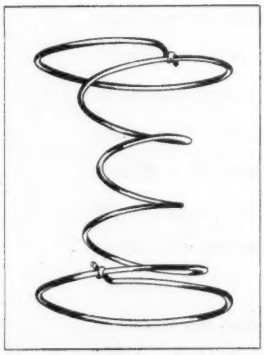
SERVING INDUSTRY FOR 75 YEARS

Avoid

"SPIRALITIS"

in Your Spring Wire

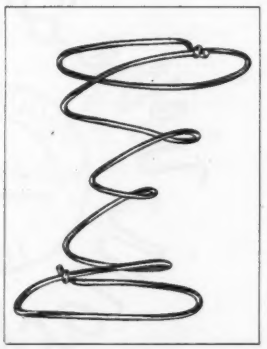
By using our STANDARD No. 91 or No. 50 Lubricants in the drawing of all Spring Wire...



Springs of even quality wire throughout make for solid comfort, long wear, and a successful product.

UNEVEN springs are often caused by inferior or ill-chosen lubricants. This directly affects the product in which springs are an integral and essential part, such as bed-springs, upholstered chairs and couches, auto cushions and the 1001 other uses to which springs are put.

For complete information on Lubricants No. 91 and No. 50, and to secure adequate samples for testing, address—



Springs of uneven quality, due to "SPIRALITIS", create discomfort and dissatisfaction, and an unprofitable product.

Standardize with Standard

STANDARD INDUSTRIAL COMPOUNDS COMPANY

4600 W. Ferdinand Street, Chicago 44, Ill.

Standardize with Standard

UPRIGHT ★ ★ ★

★ ★ ★ CONE

Wire Drawing Machines

FOUNDED WATERBURY FARREL 1851

These high speed machines are available in several sizes and can be had with either a coiling block or spooler. The spooler may be an attachment or a separate floor-type device, such as shown. This is the No. 4 machine with belt-type cradle spooler. It is driven by a direct-coupled motor (not shown), has 13 dies and capacity for drawing copper from 1/4" maximum starting size down to a finishing size of from No. 10 to No. 18 B. & S. gage. The dies and the hardened steel drawing rolls are enclosed by a rolling steel curtain to confine the splash of the drawing lubricant.

WATERBURY-FARREL
FOUNDRY & MACHINE COMPANY
Waterbury, Connecticut, U. S. A.
SALES OFFICES CHICAGO CLEVELAND NEWARK, N. J.

WIRE AND WIRE PRODUCTS

A monthly publication devoted to the production of Wire, Rod and Strip, Wire and Rod Products and Insulated Wire and Cable

DRAWING — ROLLING — EXTRUDING — FORMING — FABRICATING

Vol. 21 JANUARY, 1946 No. 1

Designated as

Official Publication By The Wire Association

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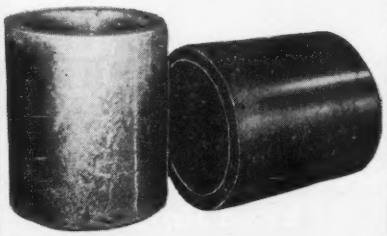
"STEVENS"
FLANGED STEEL
TRAVERSES



FOR WIRE AND CABLE

Sizes: as light as 18 gauge steel and as large as 56" in diameter and 56" in traverse Furnished in plain, painted or hot-dipped galvanized finishes. Width of flange and size and number of bolt and drain holes made to fit customer's requirements.

Assembly costs reduced by eliminating labor of handling a large number of small parts. Number of trips per reel increased 50% to 100% before cut downs or complete scrapping is necessary.

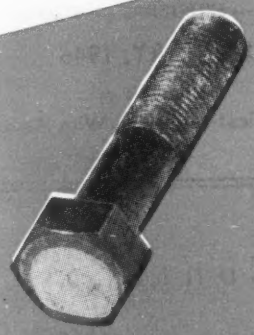
Manufactured under license arrangements with Western Electric Co., Inc.

THE STEVENS METAL PRODUCTS CO.,
NILES, OHIO

Why Firthaloy makes better Bolts

MADE WITH FIRTHALOY

Clean, smoother. Beautiful burnished head finish on flat and chamfer

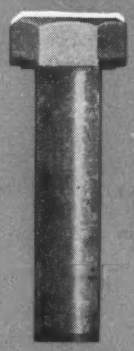


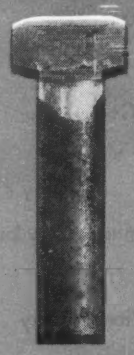
MADE WITH STEEL

Shaving necessary under head on both shank and washer face.

MADE WITH FIRTHALOY

Shaving eliminated smooth, uniform finish on both shank and washer face.





MADE WITH STEEL

Marred, scored, scratched, unequal tolerances

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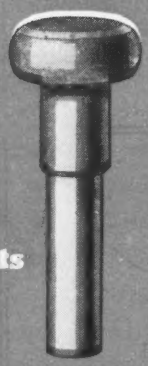

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DRAWING — ROLLING — EXTRUDING — FORMING — FABRICATING

Vol. 21 JANUARY, 1946 No. 1

Boundaries

By John C. Callaghan

Works Manager, Canada Works,
Steel Company of Canada, Hamilton, Ontario, Canada

THE MORDICA MEMORIAL LECTURE

— 1945 —

This Lecture was presented at the Annual Wire Association Convention held at Chicago, Ill., October 15th-18th, 1945.

FOREWORD

THIS year has been crowned with success to our Armies in a way undreamed of at the time of our last meeting. With fear of defeat removed from our minds, the tendency will be to accept Peace only too lightly, disregarding its responsibilities, on which our progress and future happiness depend.

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MUCH history has been made, and those coming after us may not profit from the lessons now given, even as we have not always profited from lessons from the past. There are many simple lessons tucked away in the dry tomes of history that are as fresh today as they were 2,000 years ago, and can be readily applied to our future progress.

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TO illustrate and colour our topic for consideration, I have chosen such a lesson from the past.

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I appreciate the honour conferred on me as the one designated to give the **Mordica Lecture** this year. You have already had 6 fine technical lectures since the inception of the Memorial to **John Mordica**, and I am sure you will be quite agreeable to the fact that this being, as it were, the sabbatical year for the lecture, we can depart from the study of something technical, and use the time at our disposal for reflection on the future of our Wire Association.

JOHN C. CALLAGHAN

Works Manager, Canada Works, Steel Co. of Canada. Vice President, The Wire Association.

THE MORDICA MEMORIAL LECTURER

—— 1945 ——

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MY search for a suitable subject for this lecture seemed rather futile until I happened to see in June, 1945, issue of the "Readers Digest" a statement by **Mr. Eric Johnston,** which read as follows:

"More than half of the world's population—more than one billion human beings—live in a state of miserable industrial backwardness and poverty. That is an immense challenge for new frontiers for modern economic audicity and development.

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THE same challenge that Mr. Johnston asks for business can just as readily be applied to work of our Association; to extending the technical knowledge and importance of the Wire Association and its contribution to the wire industry as a whole.

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PRACTICALLY all of our Post-War planning (frequently too glibly referred to) is predicated on

IN MEMORIAM

JOHN MORDICA
1873-1937

new and extended frontiers or boundaries. To this end our thoughts at present are centred on the health and progress of our Wire Association (And, by the way, I feel that this is the best memorial tribute we can give to John Mordica).

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THERE are some here today who, in 1930, formed that small group which crystallized the thought into action that there was a place in the wire industry for an association of practical men who, to their individual advantage could exchange ideas. This may seem to have been a selfish motive, but out of this came a constructive growth of our Wire Association far beyond the dreams of those who first formed the little group with a forward outlook.

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THE Wire Mill men, at that time, were particularly noted for their secretive attitude towards all those who tried to draw from them some of their fund of experience, and there was the tendency to hold carefully to all the apparent knowledge and skill they thought they possessed. There was, however, in this group one outstanding personality who, in a most generous way, shared his knowledge and experience in a helpful way to others in the Wire industry and from this characteristic of friendly assistance and sound directional guidance came the reason for respecting the memory of **John Mordica**—the first President of our Wire Association.

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IF nothing else had been accomplished than removing secretive attitudes towards releasing common knowledge, both technical and metallurgical for the benefit of the industry as a whole, then the Association's primary objectives were reached. But primary objectives when reached must be maintained, and there must still be the desire to expand the boundaries of our common knowledge, which is the responsibility of all who form a part in this worthy aim.

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TO colour our remarks without too much over-emphasis, leaving them to a degree inferential, I will dwell briefly on two incidents in history—one ancient and the other quite modern.

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IT happened some years ago when reading one of **Elbert Hubbard's "Little Journeys into the Homes of the Great"** that my attention was peculiarly arrested by a simple story he related. It was about the Roman Empire at the time of Augustus Caesar. I quote the passage as Elbert Hubbard relates it.

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THE grandeur that was Rome occurred in the reign of Augustus Caesar. It was Augustus who said "I found only mud and I left it marble!" The impetus given to the times by Julius Caesar was conserved by Augustus who continued the work his uncle had planned, but before he had completed it, he grew weary. The weariness he expressed was also the old age of the nation, and Caesar Augustus said 'Rome is great enough; here we rest.' He merely meant he had reached his limit and had enough of road building.

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AT the boundaries of the empire, at the end of each Roman road he set up a statue to the god "Terminus". This god gave his blessing to those going beyond and a welcome to those returning, just as the Stars and Stripes welcome the traveller coming to America from across the sea. This god also supplied the Railway world with a word.

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THE reign of Augustus marks the crest of power of Rome, and on a crest is where no man or nation stays. When you reach it you go over and down the other side. When Augustus set up the Termini announcing to all mankind that this was the limit, the enemies of Rome took courage and became active. The Goths and Vandals, hanging on the skirts of Rome had learned many things, and one of the things was that for getting rich quick, conquest is better than production.

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THE barbarians, some of whom evidently had a sense of humour, had a way of picking up the Termini and carrying them onward and onward and finally they smashed them entirely, somewhat as country boys out hunting shoot railroad signs full of holes."

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THIS is the end of the brief story told by Elbert Hubbard, but the inference that the Vandals sacked Rome eventually is a simple fact of history.

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IT was an intriguing thought to me, and I wanted to find out just what were the actual boundaries referred to.

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IT was in the year 16 B.C. that Augustus Caesar had a serious problem thrown into his lap. His great desire was to secure peace and prosperity for his empire. For many years the boundaries had extended outward, including practically all those lands bordering on the Mediterranean. Roman power had also extended North from Italy into Helvetia and Gaul (now France). The area known as Czecho-Slovakia was included also, and that part of Germany west of the Rhine.

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EXCELLENT highways had been built to the limits of empire. Roman soldiers patrolled these roads. Roman law was practiced and taxes collected by the Roman provincial governors trickled into the imperial treasury. Emperor Augustus, however, was particularly disturbed by the fact that Marcus Lollius, his Legate commanding his forces of the Rhine, had been severely defeated by a horde of German invaders.

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THIS attack on the majesty of Rome and a flouting of imperial power by the German warriors determined Augustus to take a firm hand in considering the question of imperial boundaries, particularly those frontiers of empire towards the North, which would give effective protection to Gaul and Italy from such warlike tribes as the Germans, for the Rhine valley was a continual battleground between the Roman legions and the enemy. Augustus, greatly concerned, took a hand in the task of setting these

troublesome neighbors back where they belonged and he appointed one of his stepsons, Drusus by name, to move the frontier Eastward to the River Elbe. This River was then to be made the strong Eastern boundary, assuring protection to the Northern Roman colony.

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I CAN assume that every schoolboy, in his geography lesson classes, has been taught where the Elbe is, where it starts, through what kind of country it flows and where it enters the North sea, but I think most of us had forgotten our geography to a greater or less degree until our attention was so pointedly directed to its importance, early this year. In fact, many have lost their loved ones in some of those epic battles by which our victorious allied armies finally reached this important river.

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THE river Elbe is approximately 200 miles East of the Rhine, having its source in Czechoslovakia, flowing in a Northerly direction for a distance of 400 miles through most fertile land—past important cities, such as Dresden, Magdeburg, then past the great port of Hamburg and finally entering the North Sea.

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WHILE it has been considered a river of importance throughout the whole history of Germany, it was of particular interest to Augustus Caesar when he decided to make the Elbe his Eastern barrier against the hostile German tribes.

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DRUSUS, after a brilliant campaign extending over six years, finally reached the Elbe; in fact, foreshadowing the brilliant though much shorter campaign to the same Elbe river, from the same Rhine as was accomplished just so recently by General Eisenhower. Unfortunately, however, Drusus died in 9 B.C. shortly after his great victory over the Germans. History showed that after Drusus, the Roman legions, with rather weak leadership, had a difficult task bringing under Roman law those German tribes who remained between the Rhine and the Elbe. These tribes were never really subjugated, mostly because the imperial leaders were vascillating in their determination to make their good judgment effective, namely, retaining the Elbe boundary and educating the wild German tribes to an appreciation and adoption of Roman law and customs.

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THE continual pressure these German tribes made against the rather weak resistance on the part of the Roman legions forced the boundary of empire back from the Elbe to where it formerly was, namely, the Rhine. The thought, however, was still dominant in the mind of Augustus that the Elbe was the proper boundary of empire to assure empire safety, but the will to maintain this boundary was missing, with the result that when his General, Varrus, was defeated trying to force the Eastern boundary back again to the Elbe, the Roman military leaders modified their thinking to a point of deciding that they would fortify the Rhine boundary, giving back to the German tribes that wide expanse of fertile land between the Elbe and the Rhine. A false sense of security was created out of the so-called Rhine frontier, and it combined the elements of weakness to such an extent that it is simply relating history to say that the untamed German hordes continued to push back the Roman line and eventually reached the heart of Rome, ending in the disintegration of what was the imperial Roman empire.

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ROMAN culture and Roman law made their imprint on every Northern colony developed with the exception of that part of Europe we know as Germany. There is every reason to believe that if there had been a resolute desire to inculcate both Roman civilization and laws among the tribes living between the Rhine and the Elbe, the whole history of Europe would have been changed for the better.

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THE seeds of Empire failure were sown on the plains of Germany, for the German tribes never learned Roman law nor understood Roman civilization, the result of which characteristic is apparent in the Teutonic race, even to this day.

JUMPING quickly from the past to the present, I believe some at least in this room today can remember the thrill and tense expectation when the news came to us on June 6, 1944, that the Allies, after a long prepared and well-developed amphibious plan, made a landing on the coast of Normandy. Time seemed to drag so slowly awaiting news of what progress was being made, but in retrospect it seems not very long before the troops were breaking through the Seigfried line and reaching points not far from the Rhine.

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MANY were the epic struggles which took place between the Normandy beaches and the approach to the Rhine and the daily casualty list brought home to us and to our friends the price of success so far.

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BUT, even before the Rhine was reached, in those fateful days of December, 1944, our courage was shaken when Von Runstedt nearly accomplished a break-through, which, if successful would have seriously set back any hope of early victory for the Allies. Volumes will be written some day telling the interesting story of how Von Runstedt's efforts were frustrated and how the fortunes of war turned in favor of the Allies. With immense supplies coming up close to the Allied armies which were being prepared for the jump across the Rhine, the stage was being finally set for the assault on the German fortress. The war correspondents have recorded by hundreds of millions of words what happened from the time of the Rhine crossing until the Allies reached the West bank of the Elbe.

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MILLIONS of lives have been lost and broken and billions of dollars spent to make the Eastern line of advance, and when the Elbe was reached by our victorious troops early this year, the boundary of war progress for the Western Allies was considered as achieved with great rejoicing.

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THERE is the hope that after victoriously reaching the West bank

(Please turn to page 112)

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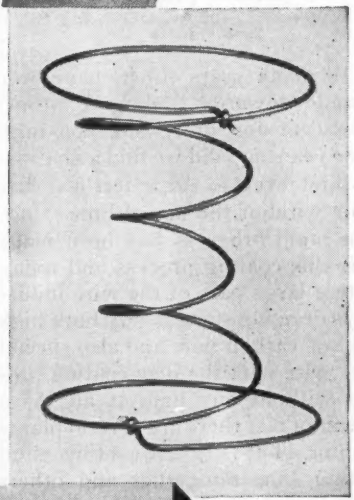

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Drawing Wire Without Lime

By Harold L. Trembicki,

Manager, Metal Coating Division,

Magnus Chemical Company, Cleveland, Ohio

A paper presented at the Annual Wire Association Convention held at Chicago, Illinois, October 15-18, 1945.

THERE have been a number of requests for a discussion at this Convention on the subject of the new wire coatings on ferrous rod and wire eliminating the use of lime. I was asked to write a paper in which I will try to give as much general technical information as we have up-to-date and some of the practical wire drawing experiences obtained so far with this coating process.

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WE are all familiar with the many disadvantages of lime, not only in actual wire drawing but also to the customer who either has his difficulties in cleaning lime drawn wire for further processing or who desires a better finished product.

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FOR many years efforts have been made towards finding a proper substitute for lime, but not until three years ago did we find a coating, the first ever to draw ferrous wire alone without the use of lime. Since then rapid progress has been made with this coating process and today quite a large part of the wire industry is drawing successfully both high and low carbon wire and also special alloy wire with the new coating process without any lime at all. As a matter of fact there are several plants running 100% with the coating, eliminating lime altogether and others are running on part production and others are using the coating process on certain special types of wire.

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THE most successful type of coating to draw wire on a steady production basis and to maintain the high speeds on the new continuous drawing machines is a compound of very low alkalinity with proper wetting out properties to give a coating which will stretch with the metal providing proper cushioning and lubrication through all the dies the wire goes through. And of course, the compound must be non-hydroscopic.

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WITH a coating of this nature it has been found that not only wire can be drawn in the wire mill, but wire in process can be coated and shipped to another plant without danger of rust and then put on wire drawing machines and drawn down as many holes as needed without any further coating. A lot of tire bead wire has been drawn and handled this way lately.

HAROLD L. TREMBICKI

Harold Trembicki has had a broad experience in new coatings for wire drawing. After being connected with the Crucible Steel Company of America for ten years he entered the chemical field in 1922 and three years ago became associated with Magnus Chemical Company of Garwood, New Jersey, in charge of the Metal Coating Division.

✦ ✦ ✦

THE new coating process eliminates entirely baking regardless of the carbon content of the wire without any danger of hydrogen embrittlement. The best and simplest method of drying rod and wire after coating is either air dried or with a hot air blast. The hot air blast is definitely the best method for drying fine wire as it quickly dries and blows out any loose moisture trapped in between the tight strands.

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IF a flash baker is used, the temperature should be reduced to 250° F. to 300° F. not over, and drying time, about five minutes. If a rack with conveyor chain is available at end of cleaning line, rod and coarse wire will dry perfectly while travelling on slow moving conveyor to wire drawing department.

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THE average procedure is the following:

1. The rod and wire is cleaned the regular way through the acid pickle and then given a thorough cold water wash with high pressure hose or automatic spraying system to be sure to remove as much as possible all acid and iron sulphate or any other foreign matter. Any improper cleaning will readily show up through the subsequent coating. The wire must be thoroughly clean.

2. Then comes the dip in the coating solution. It is best to use a weld-

ed steel tank but if not available, a wooden tub can be used. The best way of heating the solution is with inclosed steam coils or a combustion burner to maintain uniform heat and economy. The temperature should be maintained at not less than 200° F. at all times.

The right concentration of the coating solution should be kept up by proper every day testing.

The pin of rod or wire is given one dip daily and allowed to remain in the hot solution for not less than 3 minutes, particularly on high carbon wire to make the metal self drying and to thoroughly heat the metal all through to release and eliminate any hydrogen embrittlement. When lifting pin out of coating solution, it should be held for a few seconds to allow all loose moisture to drip off.

3. Dry as previously outlined.

4. The coating when properly applied will give excellent rust prevention in all kinds of weather and the wire can be drawn right after coating and drying or can be stored and drawn any time after.

Some of the advantages from actual production experiences have been:

1. Definitely better die life, particularly on the new high speed continuous machines.

2. A more uniform and better finished product.

3. An easy to clean and better wire for galvanizing, tinning, plating and any other finish.

4. Better bright wire.

5. Better welding wire.

6. Better tire bead wire and rope wire.

7. Better wire for wet drawing with liquor, copper or zinc finish.

8. Good protection against rust.

9. A considerable saving in amount of lubricant used.

10. A clean plant.

✦ ✦ ✦

A GREAT step forward has been made toward finding a proper substitute and eliminating lime in wire drawing and I believe the time is not far off when further improvements will be made and all wire will be drawn without lime altogether and probably with very little additional lubricant used in the die box.

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WIRE ASSOCIATION PROCEEDINGS

Meeting, Monday, October 15 — 2:30 P.M.

Chairman of Meeting

Dr. S. A. Braley,
Director of Research,

Stainless Steel Products
Pittsburgh Steel Company,
Pittsburgh, Pa.

Cleaning and De-Whiskering Nails
by N. Ransohoff, President
The Ransohoff Company,
Cincinnati, Ohio
Published
October, 1945—Page 733

Molten Salt Baths for the Wire Industry
by F. R. Morral, Metallurgist,
American Cyanamid Company,
Stamford, Conn.
Published
October, 1945—Page 736

Submerged Combustion,
by H. N. Snowden, Works Manager,
Seneca Wire & Mfg. Co.,
Fostoria, Ohio
Published
October, 1945—Page 750

PAPER: CLEANING AND DE-WHISKERING NAILS

Chairman Braley: Before we introduce the first speaker, I would like to say that subsequent to the speaker's paper we will have open discussion. We want everybody to feel perfectly free to enter the discussion in these meetings. We are not going to request you to give your names or the companies with which you are associated. If you wish it reported as such, you will please give your name to the stenotype operator and you will be permitted to edit your remarks if you so choose. Everyone keep that in mind in the subsequent discussion of the papers we will have free and open discussion because I feel there is as much good comes from that as any part of the paper itself.

We have for our first speaker today a man who is going to speak on a subject that I believe is entirely new to The Wire Association. To my knowledge, and I don't think I have missed any meetings since the first inception of The Wire Association in Buffalo, we have never had a paper presented on nails. The production in itself has been a fly in the ointment in lots of places in various and sundry ways. It may be possible that we will have some way out on this matter of nails. Consequently, we are very pleased to have today a paper on "Cleaning and De-Whiskering Nails," by Mr. N. Ransohoff, President of The Ransohoff Company of Cincinnati, Ohio. Mr. Ransohoff.

[Applause]

. . . Mr. Ransohoff abstracted his paper . . .

Chairman Braley: Are there questions?

Member: There is one question I would like to ask. How do you prevent the nails from sticking in the rattlers?

Mr. Ransohoff: Well, you see, they will dry out while they are tumbling.

Member: Hold them back, do you?

Mr. Ransohoff: We haven't had any difficulty as long as they left them right in there until they were dry.

Member: There will be none held back? Sometimes the coating solution sticks.

Mr. Ransohoff: It is a good question, anyhow, because everybody will think about sticking. We have been building cleaning machinery for a good many years and sticking in the mixing of batches is decidedly important in practically all types of small metal manufacturing, anything particularly that is assembled automatically or any small parts that run close to size, you have to build your machines so they will clean 100%.

Member: One more question about the whiskers. Won't a lot of the whiskers go into the tank of water?

Mr. Ransohoff: No, the tank is constructed with a pan right beneath the mill and that pan slopes to a basket, so that your cleaning compound has to go over the pan and through the basket before it returns to the pump. Another thing I might bring up there has a bearing on the subject of maintenance, is that people will immediately wonder how about maintenance on your pump. Maintenance on a pump pumping cleaning compound is high if you use a pump with a stuffing box on it. We used standard pumps for years. When it came to casting cleaning, we couldn't get the pumps to stand up, because there was sand in the water and it was really bad. So we tried suction pumps without stuffing boxes. The difficulty with such pumps was that we didn't have length enough to the shaft and the hot vapors would come up and bother the motor. So we have developed our own pump. It is made with a very light impeller welded right on the end of the shaft and by building the pump that way we are able to take a heavy shaft, 15/16ths shaft, which is a big diameter shaft, but we can get 36-inch overbushings without any vibration. We use a couple of standard roller bearing pillow boxes way up on the solution and drive it with an "E" belt. So that we completely eliminate any maintenance excepting the two standard ball bearing pillow boxes. We used that pump in casting cleaning machines and then later, because it was so successful, we used it on all our washing machines. We have found it very successful all the way through in the elimination of maintenance.

Member: Mr. Ransohoff, supposing your range of sizes in nails varies from perhaps very small brads, say a quarter inch long by a very small diameter wire to 60-penny nails, which are, of course, very large. Now, in order to separate the whiskers from 60-penny nails, you must have very large openings from the flange screens, so large that if you put the very small brads in there the whole thing would go through.

Mr. Ransohoff: Wouldn't your brads run in smaller quantities, smaller bunches?

Member: Yes.

Mr. Ransohoff: Then what we recommend in a condition like that, for instance, up at Townsend, where they have smaller batches and a lot of small stuff, they have quite a few mills with 4-cubic foot capacity that you would build for a certain range for your brads. Our range is from 2 cubic feet to 40 cubic feet. So for small nails, which would probably run in smaller batches, we would recommend one smaller unit to take care of those, and the larger ones, we have found anything from a box nail up. What size nail is that, fruit box?

Member: They will range from, say, three-quarter inch.

Mr. Ransohoff: These were about 1¼ inch. From then on up we can have one screen to do it.

Member: You would probably have to have three different screens.

Mr. Ransohoff: One thing we have found for the design of the screen for separating, the man who has been separating nails from sawdust knows a lot more about the screen perforations, the distance between the screen and the blind, he knows more about that to suit his own conditions than we do. So in building these machines, we have usually used the design that the mill has used for a number of years and found successful, that is, the size of the nails and separation. Of course, with your small nails we would recommend a small mesh, and the screen would be set for that size nails.

Member: Wouldn't it be possible to change screen meshes?

Mr. Ransohoff: Yes. They are bolted in. These screen patches are bolted in. Of course, we haven't found any real quick way to change them. You have to unbolt them and take them out. I suppose that might take an hour, or it might take two hours to get those out because there are

quite a few of them. We haven't found any quick method of changing them.

Member: How do your costs compare on this as compared with the other, that is, figuring first cost and cost of operating?

Mr. Ransohoff: If you take into consideration the construction, of course, the first cost is a great deal higher than the old style tumbling mill. But if you take into consideration the conveyors, hoppers and mezzanine and the equipment that goes with the old style tumbling mill so as to save labor, your total installation cost per keg per hour would run the same.

Now on maintenance, probably our maintenance per hour might run a little higher, but since our keg production per hour runs a great deal higher, our cost per keg will be down below the average. Then, of course, the other costs that are eliminated besides the labor are the sawdust cost, which in some places is quite an item.

Member: How long does it take to clean it?

Mr. Ransohoff: These 40-keg batches, we can handle two an hour.

Member: I came in late. You may have brought it out, but in cleaning various sizes of nails, for instance, you have an 8-penny nail and want to follow it up with some other size. How much time do you have to allow for them to clear themselves? Or would there be no mix?

Mr. Ransohoff: No mix. The whole trick of that is to design your mill and, as I said before, that is not only involved in nail cleaning, but in every type of cleaning of small metal parts. Just as an aside, not that it has anything to do with nail cleaning, but sometimes you run into small, flat objects that have to be clean and they stick by capillary attraction. In that case, we build a machine completely lined with screen to break the capillary attraction so it will strip itself. In other words, it is a cardinal fact in the building of cleaning machinery that you occasionally run into jobs, in fact, the majority of jobs, where the machine has to be built so it will be cleaner completely and no mixing. And that applies to nail machines. So there is no mixing. We have overcome that. In other words, your two batches per hour, and that depends somewhat on the time it takes to get the whiskers off, or if the whiskers are completely separated before they go in, the two batches will vary a little.

Member: Getting back to the question that Mr. Clifford asked, where you have a range of sizes, for instance, we have a range of sizes that runs from 20 gauge up to ⅜ths diameter. I take it you need about three of those machines unless you change the screens.

Mr. Ransohoff: Yes, you would probably need either two or three unless you change the screens.

Member: In a lot of cases the whiskers are greater in diameter than the nails.

Mr. Ransohoff: Your smaller nails always run in smaller batches so there won't be any reason for tying up a 40-keg batch machine to clean 4 cubic feet. We run into the same thing with Townsend. They have all sizes and batches. Most of their machines are 4-cubic foot machines. On the other hand, we get up into the mass production of nails. Then we get up into the 40-keg machines. Now we build anything between. In fact, we go below four. We run from 2 cubic feet up to 40, which is our range on batch sizes.

Member: I want to ask if there are any bottlenecks in production? You know, since carbide tools, particularly carbide cutters, have begun to come in, the points have been cut a hell of a sight cleaner than they used to be and the fellows who are still using steel knives have been stimulated to do a better job. In some plants, you can look around all day without finding a whisker that is clinging to the nails. I expect a hot detergent will take the crap off those nails in an extremely short length of time and if you used enough batches you could get those whiskers out. And I wonder if the bottleneck isn't the time it takes to knock off the cleaning whiskers and polish the pot?

Mr. Ransohoff: Correct. We are expecting that with freer whiskers, the nails will be freer of whiskers than they have been, therefore, we are increasing the size of the batches over what we had previously. In other words, the size of the batch before had to be just enough to get rid of the whiskers as fast as it was tumbled off the nails. We could hit that two batches per hour up to three batches in two hours, depending upon how tight the whiskers were cleaned. Now with the whiskers free, we may be able to get below that half hour per batch. Since we realize that the nails will be coming with the whiskers freer than they have been, we are increasing the size of the separating batches.

Member: If you had no whiskers to contend with, how long do you figure it would take to get that stuff off the nails?

Mr. Ransohoff: Eight to ten minutes. You could do a batch in fifteen minutes easily.

Member: If you did that, the bottleneck would shift to some other point. How about the sawdust tumbler?

Mr. Ransohoff: Sawdust tumbler? You could hit in there in fifteen minutes. You see, you don't have any polishing to do in the sawdust. All you do in the sawdust is wipe off the wetness.

Member: How about the time required to get the nails from one unit into another?

Mr. Ransohoff: If you figured you could clean, say, in eight minutes, you could probably discharge in about ten more.

Member: Ten more on top of the eight?

Mr. Ransohoff: Yes. That would run up to say eighteen minutes, then. It has got to be clean; your mill has got to be clean.

Member: Your mill has to be absolutely empty.

Mr. Ransohoff: I may be high on that

Member: I think you may be right on the ten minutes. I think you may be high on the time required to get the crap off the nails. A hot detergent will take the stuff off the nails in three or four minutes. It wouldn't surprise me at all to have it come down to three or four minutes. I have thought about it a good deal in the past few months. Whether you have got to widen out the tail end of your machine and get more kegs in there or you will get a bottleneck in there.

Mr. Ransohoff: Somebody brought that up; somebody mentioned that at lunch. They wanted to know if we could put more than three kegs across there. It is only a question of making that pan large enough to put five kegs across there. That is simple. It is a question of putting the right vanes in the right direction. You can make the nails spread over a 5-keg pan very easily.

Member: Do your nails go over the same screens the whiskers separate out from?

Mr. Ransohoff: You mean, in the mill? The first mill has screen panels set flush on the inside.

Member: Your nails revolve against it.

Mr. Ransohoff: Your nails go over it, yes.

Member: In, say, a 3 casing nail, with substantially no head on it, it will go out the other way.

Mr. Ransohoff: That is what your blind plate on the other side of the screen is for. You have a perforated plate and in a certain distance you have a solid plate. I think it is what they called a blind screen. What we have begun to call it is a blind screen. We use it a good deal where they have to separate something that hasn't a head on it. It can go in so far but the whisker goes in and comes out.

Member: The only thing that would have its effect would be the shortness of the nail.

Mr. Ransohoff: The shortness, and if it gets small enough so you can have the size in the hole. Now if your nail is small enough so it goes in diagonally, it will go in and slide past the plate. It is just a question with each job of working it out to fit the conditions.

Member: Supposing you strike a size nail just about the size of the hole in the screen. Won't your nail stick?

Mr. Ransohoff: We haven't gone into that yet because the nails in general won't go into a place where they will stick. I found one case once of sticking. That was stampings, it wasn't nails. There were holes punched in the stampings. Some of those stuck.

Member: Sometimes they will stick in the hole and the rest will fall over the top and bend.

Mr. Ransohoff: That will happen. The way we take care of this, the separating screen is below the surface of the rest of the barrel. In other words, if this is the bottom half of the barrel, now this is a ¾-inch plate. Now, instead of making that screen flush across there, so that if a nail did stick upright the whole mass of nails would bend over it, we depress this and our separating screen is down here. So that as this rotates, the only mass of nails that are level with that and pushing against that nail are just this couple of inches above there and the nails are strong enough to stand that. In other words, the screen is not flush with the inside. The screen is set. In other words, if this is the bottom panel, the separating screen is set down in here. So that as the nails come down in there, they get down and out, so that the only mass of nails that is pushing on a nail that happens to be sticking up is just this couple of inches. The rest slide over. This did eliminate the bending.

Member: How do the nails get down to that screen?

Mr. Ransohoff: This is your barrel. This edge here pushes all these nails further down, so that they don't get a chance to slide against any nail that happens to be sticking up. In other words, your division will be between the batch of nails down here and the nails up here. These will slide over the other ones. But the wall of this depression in the mill will push these nails up until they have a chance to fall over. They won't slide past and bend any nails that happen to be sticking up. That was one of the things we had to work out though to prevent bending.

Another thing we had to work out was an effort to build the barrel inside to prevent balling of the nails. But we have that worked out. We have the proper shape barrel and things inside so that the nails will stay a loose mass and won't get into a ball, because when they got into

a ball they would bend. That has been worked out.

Member: Mr. Ransohoff, there is a lot of button pushing to do around here and the quality of labor available quite frequently in the hammer mill is just about equal to pushing buttons, but they are also equal to pushing the wrong two buttons in the wrong sequence. Have you taken any steps towards synchronizing these operations and putting them onto a switch?

Mr. Ransohoff: We haven't done it on a nail job but we did it with very good success in the U. S. Cartridge plant in St. Louis. There we had three units synchronized. The first unit was made of stainless steel, which was tumbled in acid and rinsed on the way out. Then they went into the soak and were rinsed again on the way out, and then went into the drier. There are three units instead of two. We had that all synchronized to turn on the pumps and everything. That was fed by a conveyor and at the set time the vibrating feeder would start to feed the batch in. That was synchronized with all the dumps and pumps and turning off the rinse water. We can do the same thing here, definitely. In other words, in that case the man would dump his load in and push one button. He could do that.

Member: Couldn't you fix it so he could dump the load and he wouldn't have to push the button?

Mr. Ransohoff: Sure, you could put the bumping bar there.

Member: Can't the clock push the button? Can't the man only keep the hopper filled up?

Mr. Ransohoff: Yes, you could do that. The only thing he would have to watch out for there, and the reason I am a little afraid of that, he might come up with his load when there is a load of different nails in the hopper.

Member: Can't you have an electric eye to fix that? You can see what I am working towards. Anything new is supposed to save labor.

Mr. Ransohoff: Supposing you did this, supposing you had a crane man coming up with it. There is no earthly reason why your crane man couldn't come up and dump his load in the hopper, push a button from his cab and go ahead. Of course, then he wouldn't have to.

Member: That implies the necessity of his arriving there at the right time. What I want the man to do is to come along, find the hopper empty and dump his load in it. Now if he comes along again, he can't dump into the hopper before it is through because the damned hopper is full.

Mr. Ransohoff: It might be half empty. In other words, the only thing you would have to watch out for then is that the crane man would have to be sure that the hopper was empty and that the feeder wasn't working. In other words, if the feeder were just finishing up a batch he would get some mixing. But all the crane man would have to watch was that the vibrator wasn't running, have a light to show whether it was or not, and the hopper is empty.

Member: It would take more than a light to stop some of these galoots. You would have to have a hand reach out and poke them in the face.

Chairman Braley: Supposing he stops for tea?

Member: What I am getting at fundamentally is this: All these new things are supposed to save labor. That is the great thing towards which everything tends during these days. Now the question arises, whose labor are we saving and what are we saving it for? Our object shouldn't be to take all the work off of the man who has got to be there anyway so he can sit on his fanny. The idea is to eliminate the man. Frankly, I can't see any labor saved on this job. I have seen a damned big nail mill with a long line of tumblers entirely serviced with one man, taking off the tumblers, filling the tumblers and putting the covers back on. It will take one man to do the button pushing around here. If you can't synchronize it and make it automatic, you haven't saved a damned thing.

Mr. Ransohoff: Yes, you have saved something. You have saved the handling of sawdust.

Member: Some subsidiary saving, yes.

Mr. Ransohoff: You can synchronize that.

Member: Most of the labor in the nail mill comes after you get to the keg.

Mr. Ransohoff: We can definitely synchronize it. We have synchronized the same type of machine. It has been done. That would eliminate that.

Member: Where do you dry the sawdust?

Mr. Ransohoff: We dry the sawdust right in the barrel. You take a three-quarter plate barrel and put a gas burner under it and you don't get a hot spot, but you get very uniform heating all through the barrel and the sawdust dries in the barrel.

Member: Maybe it is a little off the subject, but it is nails and that is, I have been worrying a good deal recently about the labor beyond the kegging plate. And I have gone around some and written around some and tried to get the idea of man hours per ton involved from that kegging plate on. There is a very widespread difference in these United States. I found a spread of at least three to one from mill to mill. Some of them were damned nice mills. So that wasn't so good. Since then, during the summer, I had a visit from a couple of fellows from India. They were pretty damned keen fellows. They had spent several months in England looking over wire and wire nail installations. They gave me a little bit of a shock. They said, "You know, we thought the United States was the country where everything was more efficient than anywhere else, but, By God, England is getting ahead of you fellows in the case of wire nails." They said, "Their equipment is perhaps no better or not as good as yours, but they have given more care and pains to the laying out of the equipment, to eliminate labor and handling." And one of the points they brought out was this very thing here. They didn't use kegs. These Indians themselves had quit using kegs on account of the difficulty in getting wood. They were using canvas bags, made of two layers of canvas, with tar between them. And at one of the English plants, they told me that the nails came down a vibrating plate and shot into the bags which were hanging there, and when the bags came up to the proper weight, the nails were shut off, a string was twisted around the bags, the bag was kicked off and walked out under its own power. The labor was down to zero.

Now I am impressed by the poor conditions that we tolerate beyond the kegging plate. I confess I don't see how to meet them right now. But has anything been done in the last four years?

Member: I don't think so.

Member: Nothing has been done in the last four years. You ought to know because you have about the best installation I have ever seen for low labor cost. It is time somebody with an inventive brain works on that situation. We are doing better all along in the mill and we are going to do a hell of a lot better still. Here is a nail cleaning operation that looks as though it had great promise. Now are we going to stop and have three times as many men in the kegging gang as we do in the whole damned outfit?

Mr. Ransohoff: You would have no men in the kegging end, and we can do that, definitely. You are completely through excepting your kegging gang.

Member: We have the possibility now of a mill almost dehumanized up to the point where the kegs come in. From there on we are back in the "Gay Nineties."

Mr. Ransohoff: Would there be any advantages in a merry-go-round for kegging?

Member: I don't care whether they go 'round and 'round or up and down.

Mr. Ransohoff: I wonder if there would be any advantage in having a merry-go-round? It could be put on here and the man who weighs them could stand on the merry-go-round.

Member: Why have a man weighing them?

Mr. Ransohoff: Wait a minute! That is a possibility.

Member: When it is so full of nails, have it stop and have the keg move away.

Mr. Ransohoff: It could be done. It would take some working out but it could be done.

Member: We have as many men, as Mr. Lewis says, cleaning nails and packing them as we have making them. That doesn't seem possible but it is true. We have eight men making 1100 kegs of nails and we have 8 men packaging them. Now eight is too many.

Mr. Ransohoff: The idea would be to have the nails shut off automatically.

Member: When you get 100 pounds in there, let it stop.

Member: I don't think you have given us a labor-saving device here, but I think this, you have given us something that could be developed into something very much more easily than the old-fashioned tumbler.

Mr. Ransohoff: I think we will save the one man.

Member: As far as labor-saving is concerned, we have only started now with this doo-hickey here.

Member: We are using an automatic weigher on chemicals that sell for 15c a pound.

Mr. Ransohoff: Wait a minute! That can be done with nails. I will tell you just how it can be done. One of these automatic electric feeders, I think, would feed nails and shut off within a half pound or so, a Toledo electric eye scale in conjunction with a Syntron or Jeffries feeder. You come off this vibrating pan and instead of going in here, you go in the conveyor, up in the hopper, and that hopper has a divided base in the bottom with an electric feeder in the bottom and it feeds until there is 100 pounds in the keg. That is that. Then the keg moves out. It can be done.

Member: You would still have to jar the keg.

Mr. Ransohoff: I think you could even put the vibrator on the keg.

Chairman Braley: Isn't that being done all the time on flour bagging and cement bagging, and so forth?

Member: It is being done everywhere except in the nail mills. I don't know what the hell's the matter. We have become sort of hypnotized. Knowing we couldn't make any money on nails anyway, we have said, "What the hell's the use? Don't spend money on a loser."

Mr. Ransohoff: You could come out of here with that.

Member: It may have a bearing on your design and what you are looking ahead to with this doo-hickey here.

Mr. Ransohoff: Cut off here and go from the conveyor into the hopper with a vibrating machine.

Member: You were speaking about shaking the keg. It reminds me of something that I saw. I saw it for the first time a few months ago. I have seen various ways for holding the kegs in the shaking mechanism. Everybody is trying to get something that will grab them quick and hold them tight. It was the simplest thing I have seen. The end of the shaker bar was sort of across, and one of the members around it, so as to hold the keg, and each keg, as it was pushed over towards the shaker had a steel ring and as you pushed the keg in it dropped the ring so it fell over the keg and over the horn of the shaker. Have you seen that?

Mr. Ransohoff: I saw that, yes. We built one like that for somebody. He had it on his old one and he wanted the same method on this, just about a half inch bar, just a round ring made of one-half inch bar.

Member: Smaller than that. About ⅝ths around, I would say.

Mr. Ransohoff: It just fits over it and you don't have to unhook it at all. You just lift the ring. Of course, the other thing is that this method will produce a brighter nail, a much brighter nail. I don't know how much advantage there is in brighter and cleaner nails but if there is any, you can get them.

Member: When you say it produces a brighter nail, are you really standing on firm ground? There are some damned bright nails made in an old-fashioned tumbler.

Mr. Ransohoff: You are bound to because you are wet burnishing. When you want a bright surface you start out by tumbling it wet and finishing up by tumbling dry.

Member: The story is current that the nails out of your machine are not only bright but that they won't pack in the same size keg—they take more space. In trying to run that down, I think it comes down to some of your early experiments when you thought you could do away with sawdust altogether. You were trying to dry the nails when they came from the tumbler.

Mr. Ransohoff: That was never followed up. We did it in our own shop. We found out definitely to get the brightness you want you have got to dry them in sawdust. By drying them in sawdust we could get brighter nails.

Member: About how much sawdust is actually consumed per ton or keg or some unit of nails?

Mr. Ransohoff: I don't think I could tell that. It is awfully little.

Member: There is a mill in India that I do some work for. They have stopped using kegs because they are shipping in bags. They naturally don't have any sawdust and they want me to get them up a cleaning method which involves no sawdust. I had great hopes of your cleaner until I found the damned nails wouldn't pack in the keg properly. I knew you used perhaps something like 10% of the normal amount of sawdust.

Mr. Ransohoff: Probably 10% of the normal amount of sawdust, yes.

Member: I wonder if you have made any effort to treat those nails chemically to stand up against premature rusting?

Mr. Ransohoff: I think that is something that will have to come from some of the things we have learned in the war. Take these machine gun links. Those were Parkerized. And there are a number of treatments now.

Member: How about ferro-cyanide neutralizing?

Mr. Ransohoff: The surface would stay the same, still a bright surface. After it leaves here, you could pass it through a bath and then dry it. Of course, you would lose your brightness then unless you tumbled it again.

Member: Sheet is handled that way. After it went through the acid pickle, it was dipped in ½ per cent cyanide solution and air-dried and left to stand for two or three weeks in normal atmosphere.

Mr. Ransohoff: Why not put the cyanide solution in the first bath? We found that also in cleaning castings. You could take castings and clean them in water, tumbling them in water and pass them through a rust-proofing bath or cyanide bath and they will rust, but if you tumble them in a basic bath so that the basic compound gets into the pores, they are rust-proof for several days. You could accomplish the same thing with your nails. Put the cyanide in the first bath and it would get into the pores and the sawdust wouldn't wipe it off.

Member: I just wondered what steps were taken to take care of the rusting?

Mr. Ransohoff: That could be taken care of by putting the rust-proofing in the first bath. Although it wipes off in the sawdust, it is still in the pores. Another thing is this, that a burnished surface will resist rust longer than an unburnished surface because the pores are closed up and these nails are really burnished because they are rubbing on each other, metal to metal, in the presence of the burnishing compound.

Member: While the subject is open, if it still is open, what have you seen or heard about keg substitutes?

Mr. Ransohoff: I have heard about cardboard boxes.

Member: There are a lot of nail men here. Maybe they could answer it.

Mr. Ransohoff: I did hear of one mill that is using cardboard boxes.

Member: I wonder if anybody has found out anything decent? The story I have heard is that kegs are getting more and more expensive all the time. I have seen plywood and various kinds of fiberboard, just a few experimentally scattered here and there, but I haven't gotten a clear picture from anywhere. Anybody know of anything that is coming up to challenge the old nail keg?

Member: Does anybody use steel kegs?

Mr. Ransohoff: I haven't heard of any.

Member: They tumble like the conventional container. We packed nails in those for a year.

Mr. Ransohoff: And you went back to kegs? Has anybody considered at all any of this chemical processing of nails, rust-proofing, these phosphoric chemical acid processes?

Member: They did some of that during the war. You will remember we developed a phosphate coating on nails in lieu of the cement coating. Seems to me you get a pretty good grip and also, conceivably you might get a surface that would rust less rapidly than even the burnished surface. The burnished surface rusts much more slowly than the rough surface. I think it is possible to include in that detergent operation in that first unit solutions with which to develop a coating on the nails.

Mr. Ransohoff: Could you do that and clean at the same time?

Member: Very definitely.

Mr. Ransohoff: Would that take off such a thing as lime and soap?

Member: Yes, it will.

Mr. Ransohoff: You would get both there. That also would work in a straight steel mill. You wouldn't need any stainless.

Member: You haven't said anything about the nature of the detergent solution. Do you specify anything?

Mr. Ransohoff: We don't specify anything, but you probably would have some ideas on that, wouldn't you?

Member: As I take it, your interest is primarily ordinary alkali cleaning for removing soil from nails. I was talking about something with which you could remove the soil and at the same time leave a phosphate coating on the nails.

Mr. Ransohoff: Would you get a bright surface?

Member: No, you wouldn't, you would get a dark surface. I think generally speaking you would have less corrosion than you would with the burnished nail.

Mr. Ransohoff: The only difficulty would be the trade acceptance of a dark nail. In wood, if you were using a cement-coated nail and had that phosphate coating base, you would have something.

Member: Do you want anything better than cement-coated nails?

Mr. Ransohoff: I don't know. It is just a possibility that it has been occurring to a lot of us for quite a while that perhaps we could make a nail more rust-proof.

Member: Have you had any experience with galvanizing nails?

Mr. Ransohoff: We have built galvanizing machines. It discharges into a conveyor and tank and then goes into one of these standard sawdust barrels of ours. What I mean is, you do the same thing, you eliminate the loss of sawdust, you eliminate the handling of sawdust, you eliminate dumping it into a barrel and out again. There you save a good deal of labor.

Chairman Braley: Gentlemen, I believe this discussion has carried on very well for the first paper. Our time is passing along. There are other papers coming up. So, unless there are some other very pertinent questions at this time, I think we can move on to the next paper perhaps.

We appreciate very much, Mr. Ransohoff, your discussion of this subject, I am sure, and we hope it may develop something in the future from the standpoint of not only saving a little labor, but also possibly taking a five dollar bill out of every keg of nails, if such is possible. We thank you very much.

Mr. Ransohoff: Thank you for the opportunity of being here. [Applause]

WRITTEN DISCUSSION

Presented by
William Adam Jr., Vice President
Ajax Electric Company
Philadelphia, Pa.

TO one interested in the story of salt bath development, Dr. Morral's comprehensive list of references from technical publications and patents will be a welcome contribution. It is an apparently complete summary of available information, and to anyone who will study all of the references listed there should be revealed the technological progress achieved in the field of salt bath heating.

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IT is suggested that Dr. Morral's tabulation of the references would be greatly enhanced if his abstracts of some of them were a bit more complete so that the story might be more fully revealed without the reader's having to read completely all the literature described. For example, the abstract of reference No. 9 states that in 1900 the use of a fused cyanide plus potassium nitrate was accepted. It would be interesting if the abstract included a short explanation as to how this explosive mixture was successfully utilized.

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THE abstract of reference No. 33 states that a salt bath was heated to 2000° F. and then gainfully employed down to a temperature below 950° F. for various anneals. In this case, too, it would have been appreciated if more detail had been supplied in the abstract giving the composition of the salt which functioned satisfactorily in the range 2000° F. to 950° F.

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IT is suggested that the evolution of salt baths is not only concerned with the development of various salt formulae, but the expansive uses of salt bath heat treatments during the last five years have not been afforded their present widespread commercial acceptance without accompanying technological advancements in both bath and equipment characteristics. These developments are largely, if not entirely, applicable to the immersed—electrode principle for heating molten baths—which in itself comprises the greatest single advancement for extension of the numerous inherent advantages of heat treating metals by immersing in liquid baths.

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A NOTEWORTHY improvement in furnace design has been the utilization of suitable refractory pots for many heat treatments previously carried out in metallic alloy pots. Ceramic-type salt containers have directly lengthened pot life in high speed steel tool hardening installations (2200-2400° F.) from the 3 to 6 months service previously rendered by alloy-type pots to the 2 to 4 years operations now established as normal service before pot replacement is necessary. Applied also to neutral hardening baths, which operate within the temperature range of 1500-1750° F., refractory pots remain in service 4 years and longer in contrast to the previous life of 1 to 2 years for alloy pots. Use of ceramic materials removed size limitations which were imposed on metal pot construction, as evidenced by the many salt baths now in service which measure 20 feet and longer.

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BY use of refractory-type bath containers, which removed previous size limitations as well as extending pot life to years, and by development of better alloys for immersed-electrode heating of molten salts, it is now economically feasible to build salt bath furnaces of any size or shape, as well as automatically conveyorizing the processing of work on a continuous basis. Many conveyorized installations are being used for hardening, carburizing, selective heating, isothermal heat treating, etc., and their designs are adaptable to any production requirement regardless of size, shape or quantity of work.

NEUTRAL hardening of carbon and alloy steels in liquid baths (free of cyanide) was, even prior to the war, a widely used practice for heat treating without incurrence of scale or decarburization; however, adoption of NE steels as a conservation measure expanded the use of salt baths in this field since the narrower hardening ranges of NE steels required the closer control of temperature and time as afforded only by this method. As a further development of neutral hardening treatments, wherein steels with constituents in a stable solution are quenched into oil, brine or water, investigations led to applying a hot salt quench in accordance with data procured from Time-Temperature-Transformation curves.

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THE consequent commercial development of this salt bath process, now termed variously "Isothermal Quenching", "Austempering", "Martempering", "Cyclic Annealing", "Hot Quenching", "Interrupted Quenching", etc., is perhaps the most significant heat treating advancement for peace time industrial application. Definitely proven superior to conventional quench and temper methods, isothermal heat treatments have drastically lessened distortion (in some cases actually less than that obtained by oil-quenching on a die-press machine) and improved physical properties on a multitude of products, a few of which are: bearings, aircraft engine parts, gears, springs, crankshafts, sewing and business machine parts, cutlery, logging tools, etc. In fact, many metal products which previously necessitated costly finish-grinding operations due to excessive warp under heat treatment, will now permit finish-machining prior to this isothermal processing —substantial savings have been effected thusly.

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LIQUID carburizing, previously limited to approximately 0.040 inch cases, is now being used for produc-

ing case depths up to 0.150 inches. A few of the many products now carburized in salt baths are: steel rolls, armor plate, gears, crankshafts, etc. Many war plants used no particular feature of salt bath carburizing to enormous advantage: several different parts could be carburized, each to varying but controllable case depths, by simultaneous immersion in only one liquid bath. This flexibility plus faster time cycles, more uniform case depths and better core structure resulting from salt bath carburizing tend to indicate increasing use of the process in post-war.

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ANOTHER new development, dependent upon the use of refractory-type pots, was the application of salt baths for annealing stainless steels at temperatures between 1650-2000° F. Here, the inherently faster heating rate of salt baths coupled with their characteristic avoidance of scale formation, established new records for high production and low annealing costs for all kinds of stainless, including: wire, rod, castings, weldments, tubes, shapes and forgings. Also, use of salt baths for annealing high and low carbon steels, at temperatures from 1250-1400° F., was given impetus.

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AIRCRAFT production needs led to the construction of the largest immersed-electrode baths ever built, some with baths weighing 85 tons. Employed for the solution heat treatment of aluminum alloys and other age-hardening metals (Alclad, Duralumin, copper-beryllium, etc.), salt baths are in operation in practically every aircraft plant today for processing sheets, large structures (up to 25 feet long), stampings, fastenings, shapes, etc.

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WAR time tungsten shortages gave rise to increasing use of molybdenum alloying in high speed tool steels. This factor emphasized more than ever the essential need for salt bath heat treatment since only by this method, as in the case with tungsten tool steels, could moly steels be hardened without any danger of decarburization or other surface defects. Universal recognition of the merits of salt baths for this important heat treatment is attested by the fact that more high speed tools are treated by salt baths than by any other method.

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IN the intensified developments of liquid salt bath heat treatments for war production, metallurgists, chemists and engineers on the staffs of heat treating salt manufacturers and furnace companies have gained wholesome acknowledgement throughout the entire metal industry for the salt bath method. Reasonably, the great number of installations plus results obtained, are indicative of continued expansive growth for salt baths in the immediate years ahead.

ORAL DISCUSSION

Chairman Braley: The next paper is one which is important in many ways, I believe, because of the various angles which have been attributed thereto, "Molten Salt Baths for the Wire Industry," by Mr. F. R. Morral, Metallurgist, American Cyanamid Company. Mr. Morral. [Applause]

. . . Mr. Morral abstracted his paper . . .

Chairman Braley: Are there questions or is there some discussion on Mr. Morral's paper? Is Mr. Adam here?

Member: Mr. Adam isn't here. I am substituting for him. . . . The gentleman abstracted Mr. Adam's written discussion . . .

Chairman Braley: Are there further comments or questions on Mr. Morral's paper? I believe there should be considerable discussion of the paper. As Mr. Morral has mentioned, in the last few years there has been considerable interest in salt baths in the wire industry for heat treating purposes as well as others, one of which has been the salt treatment for the manufacture of annealed wire, and so forth, as well as a good many heat treating operations and some that have been applied to the tempering of spring wire, and so forth. Are there any questions or comments?

Member: You might have Dr. Morral comment on the use of the sodium hydroxide in the pickling operation.

Dr. Morral: There are essentially 2 processes using NaOH. In one electric current is used; to the other chemicals are added. (See table I, item 2, a. b. & c.). The idea is to reduce oxides and other impurities on the surface of the metal.

Chairman Braley: I believe what you are referring to is the cleaning process which is being used for pickling of stainless primarily with the hydride process by du Pont.

Mr. Ross: Mr. Chairman, I noticed Mr. Morral's paper was to discuss this and that is why I stopped in. I thought there might be some questions. The caustic is 700° F., just above the melting point of caustic, and we dry the caustic either by adding sodium or sodium monoxide, so there is no moisture present by any analytical method. At that point the bath is dark and quiescent, very black. And we generate sodium hydrate in that bath by a row of generators along the side by just bubbling hydrogen gas through sodium at 700° plus or minus 20 and we build up a concentration in that bath of 1.5% to 2% sodium hydride. If you had 7% or 20%, there would be no point in it because your oxidation surface loss would be too great. We have handled practically everything we tried at 1.5% or 2%. At this point, when we get the bath in this condition, we have taken practically any grade of stainless, alloy steels, by metallic strips, sheet strip, take the stainless steels, brazed and welded articles, carbon steels, cast iron steel, chrome-nickel steel, chrome steel, cobalt steel, composite sheet, copper, high-speed tool steels, Inconel-Nickel, Nichrome and Monel, and we have been fooling with castings and galvanizing and metal-coating of those and probably wondering what that reaction is. Well, basically, in the case of iron oxide scale, you react Fe_3O_4 with NaH and you get formed water and metallic iron. Every metal practically is reduced to the basic metal except the chrome oxides, on which there is some question how far they will go. They do, however, go far enough that they drop off. We carry our work from the bath into the quench and the metal at that stage is in a powdered form and most of it drops off in the quench tank. There is a small percentage left behind in the bath and has to be taken out of the sludge. And if you are not interested further in an extremely bright finish, take it as it is. However, if you want an extremely bright finish, like this 18 and 8 has, why, usually a 2 or 3-minute dip in dilute acids, combinations of nitric and sulphuric, or whatever happens to fit the particular type of work, will do it.

I want to bring out this point, that when this reaction is complete, which usually takes in a large roll of wire, you see, some of your furnaces take 2,000 pounds of stainless wire, why usually the reaction is complete in fifteen to twenty minutes and you can leave it in another twenty-four hours if you wish and it won't do it any harm and won't do it any good. When the reduction is complete, the reaction is complete. This does not attack the undercoat. And that particular industry, in the case of stainless—the Majestic Steel Company, I believe it is, has one of those—in the case of pickling, by the time the scale is stainless you can't find any iron much on the back.

That describes it pretty well. If there are any questions, I would be pleased to try to answer them.

Chairman Braley: Can you give us the relative costs as between this method and sulphuric acid, considering the losses?

Member: I heard one user say this saves $1,000 a day. But when you start talking costs in stainless steels, it isn't fair to compare this with acid because in many cases acid simply will not do it and they have to use smoke methods to break the loss, and we hate to discuss cost because it is a function of the surface. Is it going to be sheet or large rod or small wire or what? But we have found average raw material costs of 50c to $2.00 a ton. And what does it do to your labor in pickling, I don't know. You know your problems there. I saw one place where they had cleaned out a room of pickling equipment bigger than this and had a tank in the corner, a quench tank, brightening tank. That is all they had.

Member: At what temperature is it operating?

Member: 700°.

Member: No chance of decarburization?

Member: No. We have a bath in the development stage of decarburization. We think we could do that.

Member: You mean you are offering this decarburization if we want it?

Member: We would like to experiment with that if somebody wants it. We are thinking of cleaning up castings. I will pass this around. This is just a sample of 18 and 8 that I have in the suitcase, before and after. Here is the hot rolled scale and here is the matched surface.

Mr. Buchanan: I would like to ask a question. Most of the work in metallic solvents has been done with stainless and higher priced steels. What development, if any, has been done on the lower carbon, carbon wires?

Member: We can clean any of that stuff. Let me state our position. This was developed about '38 or '39 and we got a couple of installations in and the war came and, as I stated, this uses sodium and we have had to keep our mouth shut until the last two or three months because we couldn't take care of anybody because WPB wouldn't let them use sodium. Those customers that had it in continued to use it but there were no more new installations that got in at all. So obviously we will take care of the stainless first and we would like to see what it would do to the basic steel and castings and things of that kind. That is all in the future for us. If anybody wants to find out, why, we are there to do any samples you will send in.

Mr. Buchanan: I think it is an important question today with the state laws more or less bringing pressure on everybody on acid disposal.

Member: That is true in Pennsylvania.

Mr. Buchanan: That is true in Ohio. It is going to be a very expensive process.

Member: We descaled a piece that had twenty kinds of welding on it, took that piece, quenched it, watched it and dipped it into the galvanizing bath and it did a pretty good job. They didn't have to worry about sandblasting that scale, which acid wouldn't touch and they could see a way whereby they could afford to eliminate acid entirely.

Member: Is it true that it would be economical with the hydride bath to operate 24 hours a day?

Member: As to what, why, the more continuous operation you get the better because we do have a 2% sodium there and oxidation is going on continually. We have two types of loss, the surface oxidation and that from producing the work. Say your bath is 4 x 12 feet and you are only using half of it. We use the floating pan cover on the other and do away with the surface oxidation at that point and the work can be started up and used one day and shut down and started up again two or three days later. It doesn't have to operate steadily day in and day out.

Member: I wonder if you will broaden Mr. McCann's question a little, please? What is it you do with the sludge or how do you handle your wastes from your process? Do you just simply dump your washing and, if so, would that be detrimental to stream polution?

Member: What is the by-product of the reaction? Is it caustic, of which the bath is made up? If so, your only sludge in the primary reduction is the powdered metal. There is some settlement to the bottom and the operators carry pans from the bottom to lift that out as it accumulates. That comes out in the quench tank. The people who are doing the operating can tell you more about that than I can. Of course, for this bright work, if you really want to brighten it you still must use a fair amount of acids to take care of that. There is some problem there but nothing compared to the old process. I think in the wire-drawn it doesn't bother at all.

Chairman Braley: In the case of wire drawing, you have to give the acid dip in order to remove the scale and in order to get a satisfactory draw. The dark-colored sludge or powdered, very fine metal which is left in the reduction of the scale is taken off or you don't get a good finish on your wire. Furthermore, in the case of a stainless and it has to be lead-coated, it will not take lead unless that is removed.

Member: The people who operate this thing know far more about it than we do.

Chairman Braley: However, the amount of sludge which you get is very small and doesn't cause any particular trouble although you do have, naturally, to dispose of a certain amount of acid as you run the pickling tanks, but the amount of acid is very, very much reduced and the time is a tremendous factor in the use of such process.

Are there further questions on this particular process? There are one or two others of these processes that I believe are used somewhat for the same purpose which is competitive with the du Pont process. Does anyone have any information on those, to go along with this paper on salt baths? Do you have any further questions?

Member: Twenty or twenty-five years ago, with 80 nickel and 20 chrome, or 6 nickel and 15 chrome, we only drew one or two baths. We were putting a big, heavy coating on and if we drew it in one bath we were lucky. Sometimes we would get it in two baths. Then we started using the salt bath. We were using sodium chloride and soda ash for quenching it and softening the scale and using gravity to lubricate. They were able to give 75% reduction area without trouble just quenching it that way. It made a big difference in the resistance wire. It was a tough job. With an 18-hole plate and you would set up 18 holes, sometimes you would get one piece through the 18-hold plate. When you used this system, you would get four or five pieces through the 18-hold plate. Couldn't you use the same salts on tool steel? We used barium-chloride and potassium and sodium-chloride mixtures on tool steels.

Chairman Braley: Are there further comments or questions?

Mr. Lewis: "Doc," you used to do quite a lot of salt bath annealing. In fact, seems to me that ten or fifteen years ago there was more of it done than now. It was quite the vogue. There was a feeling in some quarters it was going to sweep the country. Of course, it had some weaknesses. Many of the salt mixtures were decarburizing in character.

Chairman Braley: A good many were, that is true, Ken., and we probably did as much salt annealing—in fact, for a long time I think we were about the only ones who marketed salt annealed wire. There was a good deal done from the standpoint of processing and for subsequent drawing and using it as annealing on that basis. One of the difficulties for using it for shipping wire was the fact that it rusted very, very rapidly, as all annealed surfaces do, especially when it has to be treated, because there is a very slight sludge appears on the surface of it, which has to be acid removed. Now as quick as you do that, you have material that has to be dried very carefully and some kind of treatment given otherwise you can't ship it or it is rusty before you get it out of the plant. That is one of the big problems.

The other is the question of plant and the localized heating. Now there were many attempts, we didn't use it, but many attempts use, and a good many have electric furnace installations put in on that basis, and again there were certain drawbacks to that, one of which is that it must be continuous operation because if it cools down you have difficulty getting started again, and there are a good many items of that kind which enter in.

Now there are plates for that. There are certain types of material that that goes into, certain types of production in which it is a very highly satisfactory procedure. However, with the cost problem and particularly with the pot life and the drag out, and so forth, unless you have very efficient recovery and the other difficulties involved, it does not compare to the cost of a good many of your other pot processes, and particularly is that true since we have developed the annealing atmospheres whereby we can use steel furnaces or atmosphere furnaces and get an equivalent result without going through the pot trouble, and so forth, which you have.

Now, of course, a couple of those processes, the one which you mention particularly, was very, very expensive because of the salt cost, because of the type of salt that was being used, which was higher than it should have been, very much higher, and that salt was being marketed, I believe, at something like 40c a pound, whereas the ultimate salt that was used cost 4½c a pound, which is a considerable saving along that score. Of course, necessarily you have considerable drag on it. There are some other difficulties involved. That is, if you go into higher carbon wires it comes out at high temperature and there is no way of cooling it down slowly. It has to be brought down in the atmosphere. However, the coating of salt which adheres to the wire does tend to stop the very rapid quench which you would get if you simply pulled it out of a hot oven, for example, or beaker.

Member: Since you have mentioned the pot costs, I think we ought to emphasize

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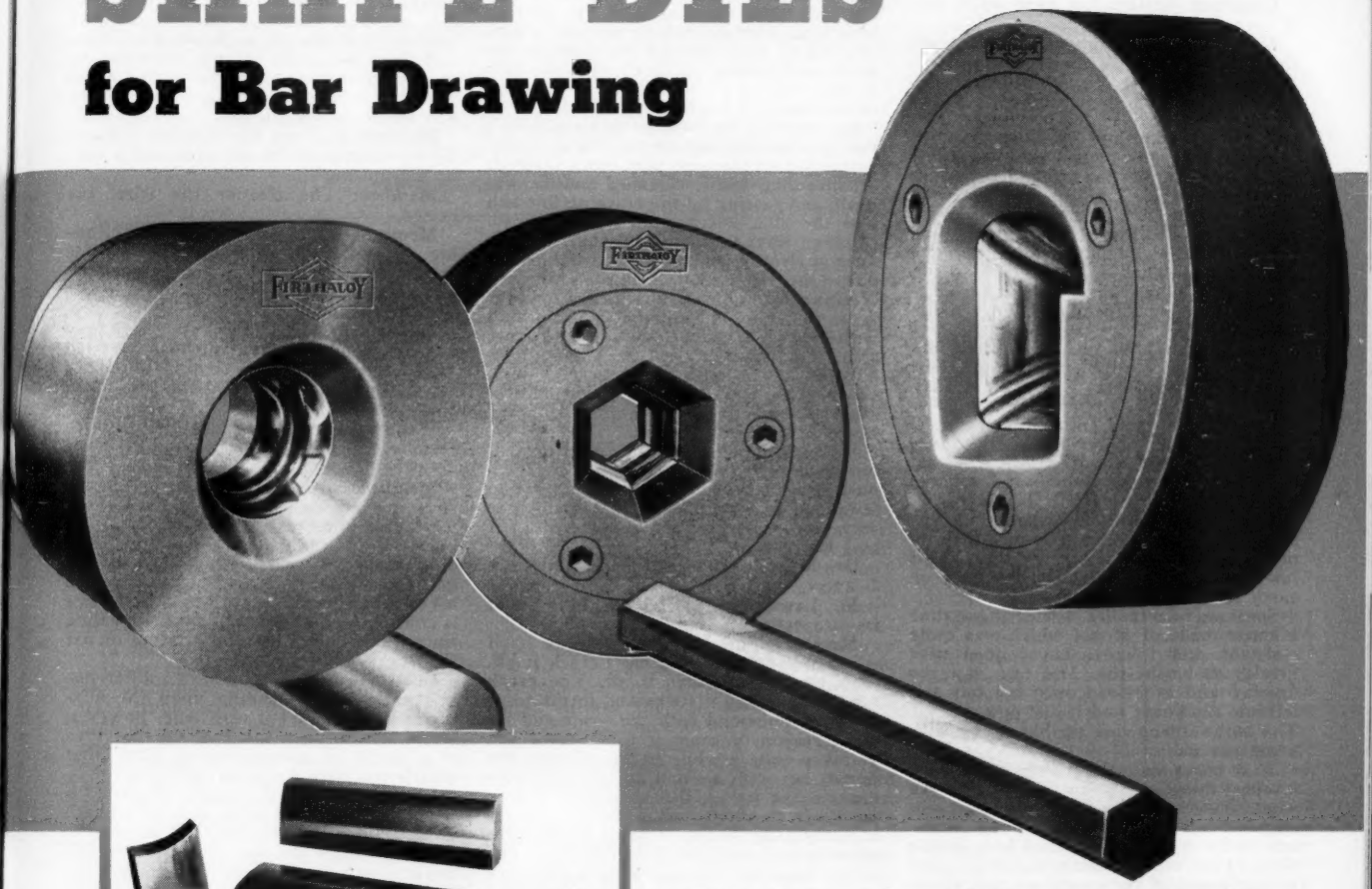

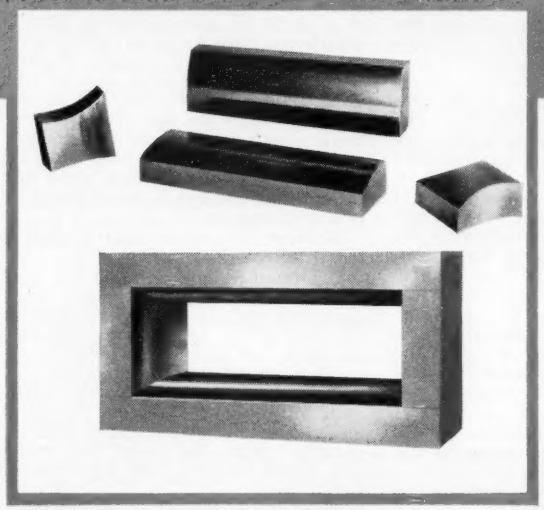

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that the ceramic pots have eliminated that problem and the design that makes possible the use of a ceramic pot.

Chairman Braley: Isn't that largely dependent upon the type of bath you are using? After all, ceramic pots in lots of cases where they have been used for a good many other things haven't held up because of the material that is being used in the pot.

Member: I can think of some salts that will eat up ceramic pots for breakfast.

Chairman Braley: Eat them up so fast it isn't funny.

Member: That is right. It depends upon the type of salt that the job requires. It is also true that some types of salts, such as salt containing cyanide, doesn't attack a metal pot provided the heating is done internally so that you get very long pot life. I think you can say unequivocably that the minimum pot life under any circumstances where metal is used is a year, and where ceramic pots can be used, for instance, on all the neutral salts operating above 1200°, the life may be up to as much as five years. That is the evidence so far.

Member: What you said about the ceramic pots reminded me of one of my youthful experiences. It was pretty nearly forty years ago that I discovered salt bath annealing. I had a problem put up to me and, after a good deal of laboratory fussing, it turned out that the best way to handle the job was to anneal the steel bath with borax, melted borax. Of course, I shifted later to anhydrachloric acid, but the principle was the same, and I found myself in the position of the fellow who discovered the universal solvent and then couldn't find anything to put it in. From my studies in metallurgy, I realized that fused borax would dissolve anything on earth excepting a metal.

Speaking of ceramics, I used at one time a kettle made of Monel which was quite resistant, and I had a cover lined with fireclay and asbestos. And one day the fireclay and asbestos cover fell out and fell into the borax and it just disappeared. The borax snapped it up like a dog with a mutton chop.

That borax annealing process was the loveliest thing you can imagine. The borax would dissolve every atom of foreign substance off the wire—soap, grease, lime, salt and any oxides that had been in the dirt and left on, the borax would pick out of the pores of the metal so completely that the finished wire looked like something that had been silver plated and not burnished. It had a marvelous frosted silver appearance and its cleanliness was such that you could do all sorts of monkey-shines with it. I did the job continually and as the wire came out of the borax pot it drew a film of borax glass with it whose coefficient of expansion was just about the same as the steel so they cooled down together and you had practically cellophane steel on the wire. I passed the wire along the scale-cracking rolls and the borax glass all cracked off and I shoveled it back into the bettle. I was just getting to where I was going good on it and I found one serious objection to it. In order to keep the borax fluid enough to be manageable, you had to run it at a temperature of something like 1700 or 1750, to make the stuff fluid enough so it wouldn't come out in lumps. I was just getting good on it when the people for whom I was working were dumb enough to fire me and I never could follow through. I was just beginning to search for some salt that I could mix with the borax to bring down its melting point without spoiling the effect. I have often wondered whether any work was being done along that line and whether any such mixture has been found. Something that Dr. Morral said reminded me that later I played with the idea and I still think it is a good idea, the use of such a salt in conjunction with galvanizing.

It seems, when you analyze it, that in galvanizing a wire, it is most inefficient to heat up the wire to red hot and then cool it down so as to pickle it, and then you heat it up again to galvanize it, and not only that, but you force the zinc to heat it up, thereby having to push a hell of a lot of heat through the sides of the kettle and raising the devil with the kettle and making a lot of dross. It occurred to me that you might have a bath of this borax, suitably doctored so that it wouldn't run so damned hot, on top of a melter kettle and let the wire pass down through it, annealing itself, cleaning and fluxing itself, and passing by the cracking line and into the zinc uncontaminated.

I even went so far as to dream of some form of electric heating which would work out so the wires would form the secondary of a transformer, or primary, whichever it is. I wasn't in a position to do anything with it but I told the story to Jack Spours and I think Jack carried the dream along a little way. Is John Morris here? I think he did some experimenting down in Peoria. Has anybody heard about it? I never heard how he came out.

But I would like to ask Dr. Morral if borax has been very much used or seriously considered and if any admixture to borax has been worked up that would preserve its properties? You spoke of borax and fluorspar.

Dr. Morral: That is the only mixture I know of.

Mr. Lewis: Can you tell anything about its properties?

Member: This mixture of borax itself when used on wire, you can't crack it off. You have to dissolve it off. You crack some but mostly it sticks and forms some kind of compound with the oxide and for some reason or other it won't come off. It takes quite a while to anneal with the borax, but with a small amount of fluorspar in the borax, the annealing time is cut down to about—when it takes twenty minutes using borax, it takes about three minutes with the borax with fluorspar. The borax-fluorspar mixture cracks off very easily and forms a very brittle glass and we have used it for galvanizing; we have also floated it in a galvanizing bath. It forms a good cover and has a lot of advantages for cleaning and annealing at the same time. That is what we use it for. If I am not mistaken, Dr. Morral did a lot of original work.

Dr. Morral: Some of it.

Member: My dream has come true then. Did you have float enough on top of the bath so it would do an annealing job as it went down towards the smelter?

Member: No, on account of the fact that under certain circumstances it will attack the galvanizing, we have to use another kind of kettle with it.

Member: It will attack anything on earth.

Member: It will take the scale off and leaves perfectly beautiful wire.

Member: The admixture of fluorspar permits you to use it below red heat. I think the minimum temperature we were using was around 1,000 degrees. But, of course, it didn't make any difference because we just left the wire in there long enough to get it up to the temperature we wanted. It didn't make any difference what the temperature of the bath was.

Member: I tried to work down around 1400° and the damned borax wouldn't wet the wire.

Member: We have used up to 1800°.

Member: You say the borax glass wouldn't crack off clean? Didn't you find it would crack off clean until it became contaminated with iron?

Member: You see, what we did, we ran the wire through the borax fluorspar bath, cracked the material off, and then ran this material that was cracked off back into the bath, that is, in the separate bath, and then we made up the additions by another open bath that was carried as an auxiliary bath so we always had molten salt added to the bath.

Member: Did you find that the extraordinary cleanliness of the wire was a help in galvanizing?

Member: The cleaner the wire, the better.

Member: It is a different kind of cleaning. It is sort of a dry cleaning. As far as my experiment in the laboratory went, I thought it would be a marvelous cleaner for galvanizing.

Member: It works very well. There may be other combinations. I suppose we tried 150 different kinds of combinations but the one we finally adopted was the fluorspar.

Member: I had one professor trying to dream out a mixture for me and he never got to it.

Member: One reason why we used fluorspar was because we had it handy. We use lots of it for the open hearth, and we knew borax was the base material. That didn't take any particular knowledge to get that out because this had always been used. But for some reason or other, there is considerable difference in the annealing time whether you use the mixture or use the borax alone.

Chairman Braley: You have a difference in the fluidity, depending upon the mixture you use. Isn't it also true, however, if you are using a salt bath of that type as a cover for galvanizing at 1,000° that that is too high for good galvanizing?

Member: Yes, that is right. We tried it to see how it would work and we couldn't get enough of it on the bath to do the work it should do, but you can get different combinations, you can make additions to the borax fluorspar mixture in order to bring the melting point down.

Chairman Braley: In other words, there is a minimum.

Member: It sticks tighter. You can't get it off.

Chairman Braley: You take the mixture, the same as lots of other salts, and you get a low melting point somewhere along the line, which is the same as with lots of other salt mixtures. However, as far as your point, Ken., is concerned, as far as using it as the anneal on the salt bath, your annealing is the time temperature and you would have to have a time temperature bath, the speed that you run, you would have to have an awful thick bath.

Member: I wanted to anneal the wire by induction and have it come down sloping into the bath so it would be red hot when it hit the borax bath.

Chairman Braley: You don't want it that hot. If you do, you will get nothing but dross.

Member: Dross where?

(Please turn to page 94)

Meeting, Tuesday, October 16, 1945 — 9:30 A.M.

Chairman of Meeting

B. L. McCarthy, Chief Metallurgist, Wickwire Spencer Steel Co., Buffalo, N. Y.

Elastic Properties of Steel Wire Intended for Springs and Formed Parts
by N. C. Talmadge, Chief Engineer
L. A. Young Spring Co., Detroit, Mich.
Published November, 1945 Page 859

Reduction of Area Values As a Guide to Patenting
by D. A. Sutch, Metallurgist, and B. L. McCarthy, Chief Metallurgist, Wickwire Spencer Steel Co., Buffalo, N. Y.
Published December, 1945 Page 923

PAPER: Elastic Properties of Steel Wire Intended for Springs and Formed Parts

The Tuesday Morning Session was called to order at 9:48 o'clock, Mr. B. L. McCarthy presiding.

Chairman McCarthy: I would like to announce that directly after the Technical Session tomorrow afternoon the Annual Meeting of The Wire Association will be held. Now there is a definite lack of attendance at these annual meetings. Everybody seems to want to leave the job to somebody else. It would be an awfully healthy thing for the Association if people would try to attend them and know a little more about what is going on and help to assist the Directors in trying to run the organization. There will be a lot of things come up tomorrow that will require an expression from the membership and the largest attendance that we can get will be desirable.

In this session, we attempted to concentrate on methods of testing and testing procedures and things pertaining to tests employed in the evaluation of wire both in process and for customer purposes. We are very fortunate in having today some representative of the L. A. Young Spring Company present, who are very large consumers of steel wire. I think they are perhaps one of the largest. We are quite fortunate therefore in having Mr. N. C. Talmadge of the Engineering Department of the L. A. Young Spring Company of Detroit present, who will present his paper on the Elastic Properties of Steel Wire Intended for Springs and Formed Parts. Mr. Talmadge.
[Applause]

. . . Mr. Talmadge abstracted his paper . . .

Chairman McCarthy: Well, we have heard this paper and certainly the subject that he is dealing with is of considerable value to the spring manufacturer and the manufacture of wire, so we should have some comments. Has anybody any questions to put forth at this time or any recommendations as to how in the wire mill we can approximate or approach what we would consider the ideal conditions? We realize that the ability to form a spring is essential. We recognize also that the strain relief treatment that is given to the spring after it is formed does certain tricks to it that makes the spring qualities possible and there isn't any reason why the corrective measures which result from the subsequent strain relief treatment can't impart to the spring all the desired properties and at the same time this desirable condition in the yield point for forming purposes should be given a lot of thought.

Would you explain those yield point values, what you used for yield point?

Mr. Talmadge: Well, it is hard to say that any one point is the yield point. So we used the Johnson Method, where the bottom part of the stress strain curve was straight and with the radius clear down to zero load, the average for the lower third.

Chairman McCarthy: The question of yield point, of course, is an arbitrary figure and if your methods of measuring any point on the stress strain diagram are the same, the characteristic which you developed by the stress strain diagram could easily be measurable. I personally don't think too much of the reference to yield point or elastic limit in the cold drawn wire. However, there is a measurable property there that, if arrived at the same way all the time, can be used in this connection. We played with some wire on a basis of high carbon, for the same tensile with less drawing and then a lower carbon with more drawing, something in the order of .65 carbon drawn to .190; and then a .45 carbon, drawn to approximately .190, and with both wire having the same tensile. What we did find was where the tensile went up and dropped off slowly on the higher carbon material, the lower carbon material came up to the same tensile values but dropped off perceptibly. We haven't done enough work on it to verify these findings yet but that might indicate that in the amount of drawing as compared with the carbon content to attain the same tensile, there may be something to study.

Now there are other factors, too, that may be important. The temperature of the wire when it is being drawn and the number of drafts for a given amount of reduction, all those factors may enter in to influence this property.

I would like awfully well to have somebody else discuss this question.

Member: Mac, wouldn't you sacrifice uniformity in an arrangement of that type? For instance, if you used the higher carbon to get your tensile, you wouldn't have the uniformity that you get with higher drafting.

Chairman McCarthy: That is true, but we are thinking altogether in terms of, say, 65% or 70% reduction for the higher carbon and then probably carrying it up to 85% for the relatively lower carbon. In that way, you would have a rather uniformly high carbon in both cases. There would be enough drafting there to more or less straighten out the variations due to the structure of the material. That was one approach that we made

Has anybody else had any experience in studying the stress strain diagram characteristics resulting from cold work or have they got anything they can contribute at this time?

Member: I noticed that the wire size .120 was lower in tensile than the size .092.

Mr. Talmadge: It was higher.

Member: That wire which is drawn more, with the higher tensile, showed that big spread between the yield point and the final breaking strain. I think that is a lead, right there.

Mr. Talmadge: They are supposed to be the same grade of wire.

Member: Well, you know that the price of spring wire has gotten down so low that most—why is everybody laughing? —that most people don't pay much attention to it. They have a standard way of making it, like they do nails, and the spring companies buy that wire as a certain grade and if we knew that you wanted wire of higher tensile, we could very easily furnish it and probably not at very great extra cost. People who make spring wire, have standardized in the making of spring wire, and put it through in large lots because it has to be done at as low cost as possible, we could easily standardize at higher strength if they would only tell us what they want. I should think there would be no trouble at all making size 120 with that large spread or any other size and do it consistently.

Chairman McCarthy: Well, I don't think you are correct in saying that the price of wire has gotten down. I think the costs of manufacture have gone up. But it is the same thing, anyhow. It isn't a desirable item from a profit standpoint.

Member: We make a comparison between spring wire and rope wire and there is an enormous difference.

Chairman McCarthy: Yes, that is true. That is one lead anyhow. Does anybody else have any contributions they can make to this question of physical characteristics?

Mr. Lewis: I can't contribute anything to the discussion but I can ask a question. Is this disconcerting situation that has been described something that has recently arisen? Is it due to the fact that the customer's requirements are getting more exacting? Or have the steel-makers or wire-makers been slipping and turning out a product inferior to what they used

to turn out? Can you straighten me out on that?

Chairman McCarthy: Mr. Talmadge, would you care to comment along that line?

Mr. Talmadge; No, I think it has been going along for ages and has been a nuisance all the time but nothing has ever been done about it.

Mr. Lewis: Is it getting worse?

Mr. Talmadge: I wouldn't say it is any worse.

Mr. Lewis: You are just getting tired of it.

Mr. Talmadge: It has seemed to me it is just something that slips. Maybe some part of the process they don't think is important at the wire mill and it could be corrected probably without any added expense. It might even be cheaper if you are doing something that is unnecessary.

Mr. Lewis: You probably realize that they are giving that wire one of the most sensitive tests that you possibly can. Anything like the spring-back after bending will bring out irregularities that I think nothing else will. Is that right, Ben? It is an extremely sensitive test for uniformity.

Chairman McCarthy: The stiffness is magnified by the recoil, you might say, after bending. You can bend it and it will spring back afterwards. That reflects the variations in the wire.

Mr. Lewis: What do you think, Ben, from your experience? Is this a situation that is deteriorating all along or is it just that the customers are getting tired and they are beginning to prance?

Chairman McCarthy: I really think that it has only been very recently that people focused attention on the stress strain diagram and some of those things in the manufacture of ordinary springs. I think the condition that exists is a perfectly natural one that has been going on for a long time but I think the spring manufacturers find that for some reason or other, through labor activities or otherwise, that they have to kind of observe the quality of their product and the efficiency of the machine operation. They are trying as hard as they can to get as much production and quality out of the machines and attention is being focused to more or less minor things; they are beginning to get more important today. The whole idea, I think, is good. If we can step up the quality of the American product, there is no reason why we shouldn't do it. I think it is very timely to call our attention to it. I don't think it is anything that has changed in the manufacturing of wire. It may be, but I doubt it. It is possible that some of these high-speed pieces of drawing equipment have introduced certain things, but, personally, we haven't been able to detect any difficulty like that in our own operations.

Mr. Lewis: As far as I have seen, the continually drawn wire is apt to be better.

Chairman McCarthy: That has been our experience, too, that you have your finger on the operation and it is a sure operation, and the resultant quality is much more uniform and much more consistent than we did in the days gone by, where the question of skipping drafts, for example, could very easily be introduced and the wire drawer could draw three drafts instead of four, or four instead of five. And today, when the machine is running, there isn't much chance of his doing that.

Mr. Lewis: I am thinking of the reputation of the fellow making spring wire. Seems to me he is getting batted around a little. I thought there was an overtone in the remarks. I thought he was sort of looking down his nose at the spring wire makers as compared with the rope wire makers, who were having relatively little trouble. But I would like to remind everybody, in case they need reminding, and maybe some of the laymen do, that spring wire is tested at practically every inch of its length. The very manufacture of springs is a test in itself. With a piece of rope wire, you test a foot on one end and a foot on the other end. In the case of spring wire, it is tested at every damned half inch of its whole length.

Chairman McCarthy: I think that is a good point. We all recognize that there isn't any more exacting test on any material than to take a large coil of wire and have it coiled into uniform springs from end to end. That is the problem and I think that the wire manufacturers have done a very good job up to date. Perfection is something to be aimed at but very seldom attained and I think it is healthy for all of us to consider the factors that are bothering the customer in an effort to try and improve it if possible.

Mr. Lewis: I would like to ask whether this difficulty is apparent in oil tempered as well as in hard-drawn spring wire?

Chairman McCarthy: Mr. Talmadge, what do you say?

Mr. Talmadge: No, it doesn't show up as much in oil tempered wire.

Member: How about music wire?

Mr. Talmadge: It shows up in music wire, but not so much. But whenever it does show up, it is as bad or worse. Of course, the hard-drawn wire doesn't get nearly as much attention as music wire.

Chairman McCarthy: Well, not only that, but I think that the music wire requirements in themselves are a little more restrictive as regards the wire mill operations. You are dealing with pretty much the same carbon. You have a relatively narrow range of carbon as compared with what you might make spring wire out of. The American Society for Testing Materials specifications say that a carbon spring wire of that quality can be made of .40 to .70 carbon. I don't think anybody tries to make music wire out of anything with such a wide range. In the case of oil tempered wire, of course, the stress strain diagram characteristics, the curve characteristics, are entirely different than the hard drawn wire and are not subject to the same variations. They are very consistent. Any heat treated material is more or less consistent as regards the stress strain diagram characteristics. But the only variation would be in slope and how high it goes, elastic limit and all that.

Anybody else have anything?

Dr. Braley: On the question as to whether or not it is new as far as difficulties are concerned, we have a lot of equipment manufacturers here, a lot of production men and a lot of fabricators. I don't think this is new at all. In the first place, equipment men who are making equipment for fabricating steel are not only referring to spring wire because they are making tremendous advances in high-speed equipment, labor-saving equipment, which puts an extra burden on the wire that has to go into it. This is not new by any means. However, when it comes to the fabricator, not too long ago, a matter of four or five years ago, I was in a very prominent steel fabricating plant making springs and I was asked the question in discussing wild wire as to what made wild wire, why it was wild, to which I replied that all the spring manufacturer did was to make wild wire. If the wire manufacturer did the same thing, the spring manufacturer didn't like it because it was wild, but all he did was to take good wire and make wild wire out of it. To which I received the reply that he had asked many men over a period of years what made wild wire and nobody was able to tell him. It was the first time he had ever had an explanation.

Now, when we come to couple those conditions and the normal development of the times, these things become prominent and that is exactly what we are up against to this day and have been for several years. Furthermore, while I represent a steel manufacturing concern, I would say this also, that as far as steel manufacturers are concerned, they have not kept abreast of the requirements of the fabricators; they have not kept abreast of the speed of the equipment manufacturers, the labor-saving devices and the combination of several operations in one, which is necessary if that kind of thing is to go on. I am of the opinion that through control you can make any uniformity desired.

Again, you mentioned the factor of price. Price is an important factor, especially today, with labor as it is. It is high. Every one is trying to cut corners. You can't cut corners and do a job. And that is the difficulty along that line. You can make most any material that you want to if you are willing to apply yourself and do the job. But it doesn't exist where I have seen it done in many cases, wherein the fabricator is perfectly willing to pay a premium for wire that he can use and does not cause him difficulty. And if you will go into the economics of the thing you can definitely prove that he can save money by paying a premium for his material. Then he can use these high-speed machines, these labor-saving machines, but he can't do it if the common run of every-day material is, as it has been made in the past and is being made today, with as little control and as little lack of responsibility as we have in the labor that is handling the operations.

Chairman McCarthy: On this question of wild wire and the control of the wire and all that, I wouldn't be at all surprised but what some of these findings here might be the result of some simple condition such as the cast or the killing of the wire. The wire is drawn straight out of the die, requiring very little cast. In order to make it conform to the block, you could make one condition. On the other hand, if it takes a decided bend and has to be killed definitely; in other words, if a wire can go out of the die normally with the setting of the die, it would produce a 16 or 22 inch diameter coil if dropped on the floor and if you would upset that immediately so that probably would produce an 8-inch coil and then straighten it back with some other device besides just cocking the die, such as a straightener roll, you might introduce into it some bend characteristics and so on that would influence the yield point value. I just offer that as another approach to seeking the solution of the problem without necessarily upsetting the cost too much.

Anybody else have anything to offer?

Member: I would like to add something in here. The matter of price was brought up and I would like to cite a specific case where we had some very fine springs to make for Cadillac. These springs went into the carburetors. They were made from .010 music wire, I believe. The loading and the rate of the spring had to be very accurate and after the spring was coiled

you could do nothing with it. Our yield in that case of good, passable springs was somewhere in the neighborhood of 5%. 95% went into scrap. In a special case such as that, the fabricator would save a great deal of his cost if he paid twice as much for the wire as he is paying for it now.

Chairman McCarthy: That seems to run true of the spring industry. As a general rule, you will find that the spring maker is not in himself dictating the price. He wants the going price. In many cases, I think they are willing to pay extra, but you have to pretty much convince them that they are getting something extra for the extra money and I think that is not too unreasonable, either. But as you pointed out, George, they certainly can save a lot of money in the spring mill with a couple of extra cents on the wire.

Mr. Lewis: How is the inherent grain size in these spring wires that we are talking about? Is there a definite standard?

Chairman McCarthy: No, there isn't any definite standard. As far as we are concerned, if any of these references are to Wickwire, although I don't see how they could be because we have never made any bad wire, ours would all be coarse grained.

Mr. Lewis: Do you believe that grain size tests are pretty carefully made on this grade of wire or has the price gotten down to the point where they just say, "Oh, to hell! We can't be bothered with that?"

Chairman McCarthy: No, I don't think so. I think that the steel manufacturers in this group who are familiar with grain size and grain size control have arrived at a certain type of open hearth operation, a certain scrap charge, and so on, which produces according to laboratory tests what they consider a desirable type of high carbon steel in the grain size that they want and with the normality that they want and as a rule those charges, and so on, don't vary much from one heat to the other, not enough to throw it out. If the grain size was really a factor, it would have to be quite a drastic change from a coarse to a rather fine and that doesn't happen accidentally in the open hearth. The steel manufacturer knows what kind of steel he is making, if he is on his toes at all, as regards grain size and if he wants a fine grain steel he knows how to get it and if his practice is set up for coarse grain steel and the practice adhered to within reason, he won't get into fine grain by accident. He would have to take a lot of aluminum and put into the ladle in order to get into the fine grain. So I don't think there is much conflict there. There may be conflict between the manufacturers because everybody doesn't agree that the coarse grain is the best type of steel to draw high-carbon cold-drawn wire from.

Mr. Lewis: Don't they all agree that a normal is essential?

Chairman McCarthy: In the hot mill operations, they would recognize trouble and see it if their steels were abnormal and full of oxides and so on. Practically all the hot mill manufacturers would more or less have that control of their steel making and it would be pretty much normal. Mike, what do you think about that? Is that a pretty true statement or do you disagree with me?

Member: Yes, Ben, I think it is. We don't necessarily shoot for any particular grain size generally. It is a coarse grain and what we do aim for is the physicals—uniform and desired physicals. Some manufacturers may desire a fine grain, perhaps in the patent treatment, and some for the better conditions. Others may feel otherwise, depending upon the equipment, drafting practices and so forth.

Chairman McCarthy: That is right, but generally speaking, they know about what their quality of steel is from heat to heat and every heat may not be connected from grain size, although some are, and if they run into trouble and have a heat that doesn't respond right, that is getting to be one of the more or less common tests in the laboratory, to see if that had anything to do with the normality and grain size.

Mr. Lewis: Is there uniform practice now in the trade with respect to air quenching patent spring wire?

Chairman McCarthy: No, I don't think there is. I don't think there is any doubt but what the ordinary cushion-type spring, that is, the spring intended for cushion manufacture, sold on the strict bottom price figure of high carbon wire, I don't think very many wire manufacturers are lead-patenting that material. It is all a product of the air patenting operation.

Mr. Lewis: Isn't it pretty safe to say that the lead-patenting had a better chance of uniformity, the lead quench?

Chairman McCarthy: No, I think there is a definite application for both and that you can get all the uniformity you want out of the air patenting. Incidentally, the paper to follow will deal with patenting along those lines a little bit and I would like to have everybody reserve their remarks and throw them high, wide and handsome later on. Is there anything further?

Member: Could I ask Mr. Talmadge if the tests on this wire, if the wire was all bought from the same company or had he tried it on the wire bought from various companies?

Mr. Talmadge: It was taken from different companies. It doesn't seem to make much difference. They have all gotten down to the same level.

Mr. Buchanan: The point has been brought up about the making of the steel. I would like to make one suggestion. It may not be of any value at all. But isn't the variation that occurs more likely to be the finish of the drawing since these curves show a variation in yield point and result from 50° or 100° change in the temperature? Isn't the temperature at which the cold drawn wire comes off more of a factor than otherwise?

Chairman McCarthy: I don't think there is any question but what that could be a very important factor, the finishing temperature of the wire. As stated before, I think there is a lot lies in the question of what the temperature is during drawing and finishing temperature.

Mr. Lewis: I want to suggest another place where trouble may creep in. That is the matter of cast. You have spoken of cast. There has been for a good many years the feeling, entirely unjustified, that such a thing as a full floating die box could be devised which would straighten itself out and give a perfect cast. Well, there is no such thing. You have got to definitely cast the wire, deliberately and definitely, and you have got to cast, if you are going to do a good job, in such a way when once cast it will stay there. That is extremely important. I was surprised when it dawned on me some ten or twelve years ago what a jackass I had made of myself for twenty years in ignoring that point. I always had the dream of a full floating die box, self-adjusting, self-aligning box which, if it was allowed to float, the wire would always be exactly actually with the die hole. There is no such thing. You have got to definitely arrange for that case and definitely hitch it right there. Otherwise, some little thing will happen during the run-off of a bundle. I have seen it happen. A little interruption of the current or something that would cause a slight jerky backlash in the wire and the beautiful cast you have arranged, if you are watching the die box you will see it slip a 64th inch out of line. Then there is trouble.

Chairman McCarthy: Yes, in that connection I recall very well an attempt in the manufacture of brush wire. This particular customer was taking the coil and he would cut it in two and chop it up into small lengths for the brush and he was anxious not to have any curvature in the small lengths. So, if I recall, he specified a wire cast to a 12-foot radius. That would be a 24-foot coil, so that when you dropped it on the floor it would open up to that—that is, the single strand would open up to that. And we attempted at that time and investigated the possibilities of how close we could come to casting on the block as it was being drawn. It was absolutely hopeless. You couldn't get any assurance at all, and all the wire had to be straightened separately and cast as a separate operation to fit that 24-foot circle. In doing that though, we found out exactly what you are talking about: that it is impossible to control accurately. Now if you are cutting it down to 16 inches, and so on, the variation is much less. That is conceded. You would never accidentally go down to eight inches or go up to thirty-six or anything like that in the ordinary die setup with the die cocked in the right angle, so you would get approximately a 16-inch coil. But when we stretched it out to 24-foot, then the variations were magnified and we would run all the way from practically a straight wire down to a 12, 13 or maybe 14-inch coil diameter, all in apparently the same coil of wire, due, as we saw, to the fact that there was more or less an uneven payoff that could influence it. For instance, if you are taking a rod to size and you don't have an absolutely round rod to start out with, there are many factors could do that.

Any further questions or remarks?

Member: I would like to ask if this so-called non-uniformity in elastic properties is confined only to carbon steel or whether you find it as a non-uniformity in alloy steel, such as copper, beryllium copper.

Chairman McCarthy: Mr. Talmadge, have you done any work on anything other than straight carbon steels?

Mr. Talmadge: No, we haven't. We don't use very much brass or hard-drawn bronze. Stainless usually has.

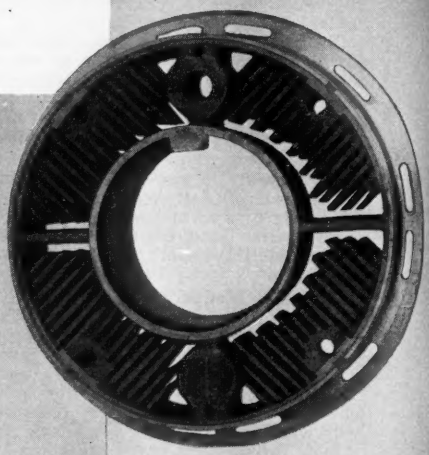
Member: My experience is that we have actually greater variation than the so-called yield in some of the stainless.

Member: In the case of the stainless wire, I would think, my observation would be that it is a matter of cast, entirely a matter of cast.

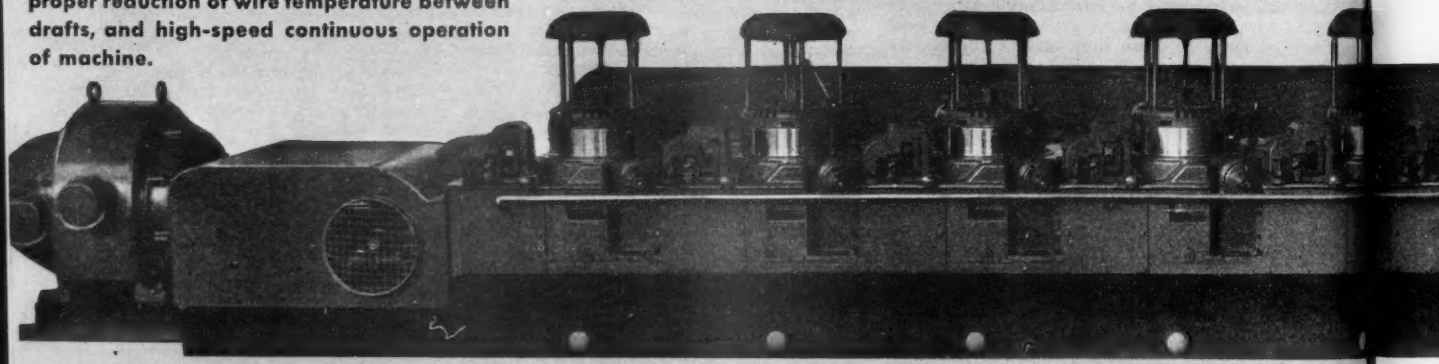
Member: Here about six months ago we had a little job for General Electric that we were supposed to straighten and you couldn't possibly straighten it because the yield was right up where the tensile begins, right next door to it, and we had to give up on that.

(Please turn to page 94)

SPEED... with



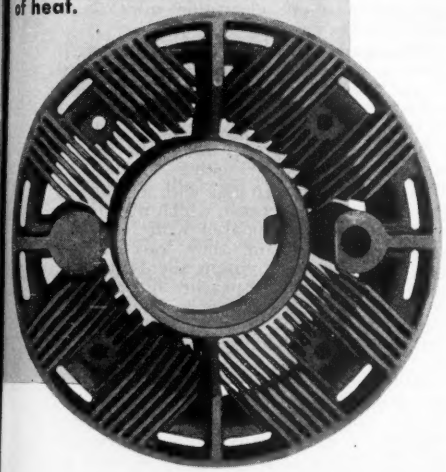
Morgan-Connor High Block Design with patented Fin-type Air Cooled Blocks insures proper reduction of wire temperature between drafts, and high-speed continuous operation of machine.



Type BW Morgan-Connor Wire Machine for continuous drawing of high carbon or low carbon wire. Machine designed for 4, 5 and 6 drafts — interchangeable finishing blocks — high block air cooled design — fully adjustable die boxes for casting wire — draw from welded bundles.

...Air Cooling...

Morgan (patented) Fin-type Air Cooled Block presents a large radiating area to insure the fast dissipation of heat.



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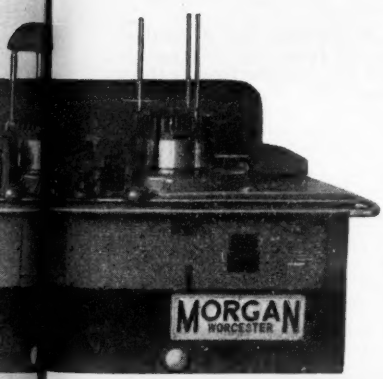

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Chairman McCarthy: The next paper on the program is a paper presented by Mr. D. A. Sutch, Metallurgist, and B. L. McCarthy, Chief Metallurgist, Wickwire Spencer Steel Company, Buffalo, New York. The title of this paper is "Reduction of Area Values As a Guide to Patenting." Inasmuch as Mr. Sutch is not with us today, we will have to ask Mr. McCarthy to present this paper. Mr. McCarthy!

Mr. McCarthy: Thank you, Mr. Chairman.

. . . Chairman McCarthy presented the paper . . .

Does anybody have any questions or remarks to offer in connection with this patenting treatment? Maybe they have a better way of doing it and they are not going to tell us.

Mr. Lewis: Ben, I could make a remark or two. All the time you were talking, I was thinking of the Trauwood outfit I saw only a few days ago, which was doing what the owner considered an excellent job. I am not a judge myself, and whose operation appeared to be violating every one of the tenets that you have laid down here. In other words, the thing was going too fast. The furnace wasn't one-quarter the length of the furnaces you are talking about. And the temperature, instead of being a couple of hundred degrees above the critical point to get good grain size, was so damned low I would have sworn it was slack patenting. In fact, I would have sworn they were oil tempering.

I don't know how much experience you have had or whether you have looked over that Trauwood process, but I wonder if the patent effect by the Trauwood method is the same process we have been thinking about all these years as patenting or if there is something else? In other words, it is difficult, as far as my observation has gone, it is impossible to resolve that Trauwood patented structure under the microscope and detect definitely any pearlite. Isn't it still an open question whether the Trauwood wire is merely an extension of the refining of the pearlite grain or whether it is something altogether different. The properties of the wire seemed to indicate it was simply an extension or refinement of patenting and yet every now and then I see a Trauwood outfit violating all established rules and I begin to wonder. And I thought of it lately, since I had an opportunity a while ago to see some work that had been done under the electronic microscope, with which you are probably familiar, which allows you to get magnifications up to something in the order of 20,000. I understand that work could be done under reflected light on that electronic microscope. I would like to ask you, Ben, whether you have any comments to make on that whole subject? What the devil is Trauwood patented wire and why do they get away with murder and what is the structure and has it been examined under the electronic microscope?

Chairman McCarthy: Well, as to why they get away with murder, I don't know. Is there anybody from the Trauwood process here? Is Mr. Trautman or any other representative here? It would be awfully nice if they were here and they could answer those questions.

Now the Trauwood Process, from what I have observed, carries with it a unique method of effecting solution. A solution of a constituent seems to take place much faster under those conditions of resistance heating than we would normally expect. That is a general statement. But as Ken indicated there, at relatively low temperature for a relatively short period of time, I wouldn't be surprised but what there may be some influence there connected with the electronics or something that has hastened the solution of the carbide particles. That being conceded, the next thing is that the second contact, which is a molten bath contact, immediately drops the temperature. In the first place, the rate of heating doesn't permit any appreciable grain growth, so you don't deal with coarse austenitic grain structure at any time. You are dealing with fine austenitic grain because you haven't had the high temperature to affect an appreciable grain growth. So all of that in combination results in, I believe, a complete solution of the constituent at relatively fast speed and at the same time very little growth in the austenite.

Now in that condition the material is suddenly plunged into a molten metal bath, which is the second contact of the wire. We are thinking about the low melting alloy for the initial contact and then the subsequent lead bath or lead-tin combination for the quench bath. Well, there the temperature is suddenly dropped appreciably, your control of the pearlite can be affected by it; the structure is pearlitic, but it is of a controlled type of pearlite, having to do again with the fact that the AR_1 transformation takes place, the temperature is lowered and the AR_1 transformation takes place before it goes out into the air. Really there you have a lead quench operation, not complete quench but sufficient lowering of the temperature to affect the transformation in line with the lead quench operation in that when it comes out into the air you don't get a true quench, you don't have a true air cooling.

Now I think, if I recall it correctly, the wire will come out of the second molten metal bath black in every case, which indicates that the temperature has already been dropped to somewhere, especially if you view it at night, it is under 1,000, so you have effected the lowering of the AR_1 you have controlled your precipitate and have your precipitate in the pearlitic state by virtue of dropping down into some temperature in the neighborhood of 900°, or in that neighborhood.

Mr. Lewis: You are convinced there is pearlite there?

Chairman McCarthy: I haven't seen any pearlite. We haven't studied any Trauwood samples to determine the presence of pearlite, but I think that the electron microscope or another method, slides for which I wish we had with us, will identify that as pearlite.

Mr. Lewis: By the way, has there been any examination of metal under the electronic microscope yet, that you know of?

Chairman McCarthy: Yes, pearlite has been studied.

Mr. Lewis: I wish somebody would send them a piece of wire because I can't get it off my mind, that problem, whether it is pearlite or whether it is something else. It violates all our rules. We always think, for instance, that we have time and temperature to think of. Now we have time and temperature and something funny.

Chairman McCarthy: Well, in this case we have time and temperature, too. We have conceded, I don't know for sure, but it looks to me like a rapid solution. That is new and strange and different. Then other than that, once we accomplish solution, we have it at a low temperature, which prevents austenitic grain growth, and then subsequently we have a short time at temperature, which also does the same thing, and then we have a sudden lowering of the temperature, similar to a lead quench, not very much different than a lead quench in that respect. Well, some of the structures produced in lead quenching and which will draw into very good wire will be hardly resolvable into pearlite.

Then in the oil bath, when they temper the material, they effect the similar operation except that they drop the second metal bath to a lower temperature and drop the lead down to a temperature low enough so that before precipitation has occurred they induce it in the oil and they get their precipitation in the oil. They drop it down so it is practically martensite and then they come back into the oil. They drop the temperature so it will quench in the martensite when it goes into the oil. You don't have time enough for transformation in the second metal bath but it quenches in the oil.

Mr. Lewis: Don't you think it would be a good idea if some user of a Trauwood outfit of an inquiring turn of mind would get access to an electronic microscope and give us a paper?

Chairman McCarthy: Well, I think if there is somebody that much interested in the Trauwood process, it might be very valuable to them and maybe to the rest of us.

Mr. Lewis: There is one right in the front row that I am looking at now.

Member: I am familiar with a study of the Trauwood process in which the microstructures were compared with lead patented structures and they looked very much alike. In my opinion, the Trauwood process produces fine pearlite in the same way that patenting produces fine pearlite and I think that is why it is successful, because you do produce fine pearlite. And if I have understood you, Mr. McCarthy, you advocate a large austenite grain and air patented because it produces fine pearlite. I would like to ask this question, whether you have any particular reason for advocating large austenite as such or whether all you are after is fine pearlite? In other words, if you can produce fine pearlite some other way, without having coarse austenite grains, would that be just as satisfactory?

Chairman McCarthy: No, it wouldn't. The fundamental theory of cold working has to do with the slip interference theory of Jeffries and that slip interference is based primarily on the normal resistance to plastic flow of the particular, say, pure metal involved and then the next in line is the resistance due to grain boundary of structures. So that the coarser the grain in the pure metal, the greater will be your ability to cold work it and the easier it will cold work without doing any harm to it. Now basically then, the coarser grain material should cold work easier and with less harm to it than a fine grain.

Now, bear in mind, I am not attempting to reconcile the success of the Trauwood process with the more or less recognized past theory of cold working. I recognize there is some difference between them.

We talk about using nothing but coarse grain steels for drawing hard-drawn wire and at the same time I know there are a lot of people who use fine grain steels and go to the trouble of making fine grain steels because they think that fine grain steels will make better wire than coarse grain steels. Now those differences haven't been reconciled yet. There may be more to it. There may be an era of learning that lies ahead where a fine grain size pearlite in line with the Trauwood process pearlite will be a more draftable material, better flowing material, than the coarse grain of the old air patenting operation. Mike, you are familiar with this Trauwood process; would you or one of your cohorts—there are a couple up in the front seat—would you mind giving your opinion of the Trauwood process? I was asked a question and I just stuck my chin out and took a chance. Maybe you can correct me on it.

Member: We are using Trauwood on the fine gauge wire and there we are using fine grain steel and we think doing a very fine job. Now I am not as familiar as Mr. Garrett with the microstructures of the Trauwood patenting and perhaps he could elaborate somewhat on what structure he thinks he has seen under the microscope.

Member: In that Trauwood system, Mac has talked a great deal about the austenitic grain size of the patent structure. In the air-cooled process we employ high patent temperatures to develop a long fiber structure in the finished wire but the structure of that austenite is relatively fine pearlite. In the Trauwood system, you must remember that we are utilizing almost to the nth degree the S-curve. In other words, we are quenching on a rising temperature right at the knee of the S-curve. There is no opportunity for the formation of a ferrite in that material and the resultant structure is practically all massive fine pearlite or sorbite. It is a massive sorbitic structure that lends itself very readily to high percentages of drafting. Now it is not directly comparable to Mac's layout here on air-cooled patenting because no matter what you do in air-cooled patenting, you will still develop more or less variations in your pearlitic structure and precipitation of pearly eutectoid to ferrite. That photo-micrograph demonstrated the different sizes of the pearlitic grains. The plates also showed the presence of free ferrite. And free ferrite will work havoc with your drawability of wire due to the very simple fact that the softer material will absorb the maximum amount of cold work until the hardness of that material approaches the hardness of the other material and then they will co-work equally. At that time your ferrite is practically overworked and you have ruined all the bending qualities of that wire.

Now the difference in a coarse grain steel is that you can take either one and make perfectly satisfactory spring wire and rope wire. However, in favor of the fine grain steel, you have the less sensitive effect, which is very important in your rope wire manufacturing and your higher tensile cable manufacturing and spring wire that has to withstand terrific knotting or bending stresses. The principal difference, insofar as I can see it, between your conventional open fire patent and Trauwood system is the quenching on the rising temperature to prevent the formation of early eutectoid ferrite and the extremely fine structure of the pearlite that results in probably the maximum of the drawability of the finished wire. That fine pearlite, sometimes called sorbite, is difficult to get away from, and your second quenching above the knee of the S-curve will tend to give you duplex structure, that is, a sorbite and a coarse pearlite, and below the knee of the S-curve will tend to promote the formation of nodular structures, both highly detrimental to the drawing properties of wire.

That is about all I have to say.

Chairman McCarthy: Well, I personally would subscribe 100% to what Mr. Garrett said. So far, I don't think it was too far away from what I was trying to say about the Trauwood process. The question of excess ferrite is definitely true as outlined by Mr. Garrett. In the ordinary air patenting operation, of course, when the carbon content gets down in the neighborhood of .45 and so on, you never accomplish complete retention of the ferrite, but you do distribute it, and in the Trauwood process it is in the same category, too. It is there but in extremely small particle size. When it does come out, it doesn't come out in a mass like the true pearlitic structure. The pearlitic area is still in the neighborhood of around .80 or .85 carbon. And there is excess ferrite and that is present in the structure but it is in such small particles that it plays very little influence on the wire characteristics.

In a good air patenting operation, especially when dealing with material running around .50 or .55 carbon or higher, you should have absolutely no network of free ferrite and a well conducted air-patenting operation will produce results along that line. You don't have to have free ferrite that is outlining the austenitic grains, pro-eutectoid ferrite, and in that respect I know that we agree. I know that with the material higher in carbon, that if you do permit any pro-eutectoid ferrite to precipitate out, that you don't have a very good working material. And I subscribe 100% to the fact that the ferrite will be the first to cold work.

There is another feature there that I think is worthy of thought. In the progressive hardening of the materials as outlined by Mr. Garrett, where we have the ferrite which will absorb most of the size reduction until such time as it is hardened to a hardness equal to the surrounding pearlite areas, along with that variations in pearlite within reason can be absorbed in the same manner and perfectly good quality material can be produced in spite of the fact that I have fully conceded that in the air patenting operation we don't have 100% uniform pearlite as regards plate thickness. It is an awfully hard thing to determine whether you do or don't because you cut a sample and look at it under the microscope and you have plates lying in all planes and you are going to section it, and some of the areas that look like coarse pearlite are not necessarily coarse pearlite. It is just that you happen to section the material with the plates at a certain plane and they look coarser. I don't think, however, that anybody should claim an absolutely uniform pearlite in the air-patented material. I do claim, however, in the same manner that the ferrite will harden and even the finely precipitated ferrite of the Trauwood type of material must harden to a point where it is equally hard with the areas around it before the areas around it will be affected by the size reduction. In the same manner, I think that the slight variations encountered in pearlitic structure will be corrected as long as those variations are not wide enough to set up a definite plate thickness in the cementite which will offer decided resistance to the plastic load in that area. Then you have gone to the extreme and you are going to have brittle wire.

Member: I would like to ask one question. You were speaking throughout your entire lecture about the austenite grain size developed in the air patenting. I am wondering what the practical limit of this austenite grain size is? By that question, I mean something like this. We no longer think of coarse grain steels of one to five. When we get to the right-hand side of your last chart, with the maximum time, what kind of grain size could we have over there? Is it a 1, 2 or 3? And by the same token, the one on the left side would probably be less. I am wondering how far it goes? For example, I will agree and concur with almost everything you have said. The coarser the austenitic grain size, the further compressed is the direct pearlitic precipitation. I am wondering, getting up into pretty big austenite grain sizes, how much effect they have, again depending upon the size of the wire.

Chairman McCarthy: I will tell you, Bud, we have done some measuring of them but we don't ever get the true inherent grain size developed. Now our steels that we are dealing with in this connection will show a range of grain size from two to four. If we get too many fives, we begin to wonder about it, and we don't like to have them go that high because it indicates, without the addition of aluminum, a lack of control of the grain size which might well lead to a duplex condition, but in the neighborhood of two, three or four. Now in that connection, I don't think that even with the most drastic treatment, which I would say is about 18 or 20 minutes at a temperature of 1700 or even the 1850 I referred to, would we get full grain growth. If we start with about 2 to 4 and wind up with a five or six, I would think we are doing very well. So I never considered in a normal patenting operation that we would go much coarser than a No. 5.

Member: That is the exact point I was bringing out, in talking about coarse grain steels and fine grain steels and so many of us think about it as the AST M-Chart, these monsters over here, and the point I was trying to develop was that when you and I talk about coarse grain steels we don't speak of those fellows down there.

Chairman McCarthy: I am thinking, sure, along about 7, 8 or 9, or something like that, over 8 the fine grain resulting from the patent. Now you can appreciate if you take a coarse grain steel with a grain size, according to the grain size test, or 2 or 3 and you don't get any more, you keep it down to an 8, that you have a pretty fine grain size for a patented rod. That is what I had in mind.

Member: That is the point I wanted to bring out to make sure we weren't talking about the great, big grains on the left side.

Chairman McCarthy: No, no. Well, Bud, is there anything else you would like to contribute?

Member: No.

Chairman McCarthy: The difference between you and I is that you admit it, see.

Member: Talking about air patenting, I think when you start the game you think you know it all and when you begin to get the problems thrown at you, you begin to realize you don't know very much of anything. I think we agree pretty strongly with everything that has been said, Mr.

McCarthy. I confess that I missed the first few minutes of the lecture and I don't know how much was contained in there. I agree pretty thoroughly with you, including your last remark as to the ability to restrict the ferrite by correcting the austenite grain size. I agree to that, too.

Chairman McCarthy: Thanks. One thing we have got to bear in mind; this goes back twelve years. We were trying to figure out how we were going to control this patented condition in the mill and that is the thing that we used and that is what came out of it. It only serves as an indication. It hasn't got any measuring stick attached to it or anything else but it has served as a good mill tool because reduction of area is not hard to test for. To take samples in a mill, about which there are some that you don't know too much about anyhow, and rub some sandpaper over them to get the scale off because you haven't got time to clean them and bake them properly and pull them through a couple of holes or three or four dies to try to get an indication of what the patenting operation is going to be for the next eight or ten hours is not what I would consider the right way to do it. This can provide a constant checkup to the fellow going along picking samples here and there at random over the whole 8-hour period while the shift lasts or for the rest of the day and week, he has a constant picture of what is doing. He can adjust speeds slightly to fit the requirements laid out by the metallurgical practice.

Has anybody else got something to contribute on patenting?

Member: I haven't anything to contribute on patenting but if anyone is still interested in the microstructure angle from the two processes after Mr. Garrett's explanation, I would be glad to run some micrographs on any samples anyone cares to submit to me. We have an electron microscope in the laboratory and we would be glad to do that.

Chairman McCarthy: I will appoint you, Mr. Garrett, and Mr. Patterson a Committee of two to investigate that as recommended by Mr. Lewis. I think it would be interesting. This is a little off the record. I didn't know this was coming up. I am sorry I didn't bring some other slides with me. We have, with the sensitive tinting, developed a means of identification of pearlite. I haven't tried any Trauwood samples. We have developed a means of identification of pearlite and Max Gensemar and I have talked it over quite a bit and it seems logical. They have identified pearlite as low as 800 but they haven't published anything on it. I don't know whether you have or not. You can see slight indications. It is a fussy sort of job and it is very difficult to see the tendency towards lamination there. But we can identify with this other method, by using the sensitive tint illumination and by revolving the stage you get individual grain orientation which results in a change in color. In that way you can identify pearlite much lower than Mehl did in his paper, where I think 1050 was as far down as he attempted to publish.

Member: As far as I can make out, you don't see an awful lot of difference in the fine pearlitic structure with the electron microscope at 20,000 than you can see very well with the white microscope. That is not a sales point.

Chairman McCarthy: As long as the sales end of it has been raised, you don't want to forget that this sensitive tint is a piece of your equipment, too. You know, what you lose on the bananas, you make up on the oranges.

I know definitely when we get a chance to explore this use of the sensitive tint further as a means of identifying pearlite, it is going to be all right because you see areas flash in and out as you revolve the stage and you know you have individual grain orientation and, following it up with other studies back of it, we know that spheroid material doesn't produce individual grain orientation, and we know that pearlite does. The plane of the plates will produce a retardation in line with the various colors and in our results it certainly can be used as a means of identification.

Well, that will be very interesting for the microscope, and even you, Ronald, might get an education.

Chairman McCarthy: I think he should. That is what I was hoping. Johnny Zur ought to be in here. I think Johnny ought to be tied in on it. He can talk this language. He has done some work on it. His process is involved. I think he ought to be tied in on it, too. There is certainly nothing about it that we shouldn't all be willing to cooperate and I am sure as far as I am concerned I will do anything I can. It is strictly a scientific point we want to establish and I don't see any reason why there should be any trade secrets or anything else involved. We don't care who makes the Trauwood process as long as it works for the fellow who buys it and he likes it and he gets results and sells the wire and makes money and pays the metallurgist. That is all I care. As far as the mills are concerned, they will have to take care of themselves.

Anyone else wish to add anything to this?

Member: Have any tests been made on the Trauwood patented wire to show what reduction of area would give the best wire? Is it a small reduction of area or large?

Chairman McCarthy: My guess is that it would all be a relatively high reduction of area material.

Member: A value comparable to the lead patent.

Member: Your air patenting showed low reduction.

Member: Air patenting your low reduction of area indicates the nodular trustite.

Chairman McCarthy: You see, in one case the low reduction of area comes primarily from the coarse austenitic grain size. A .65 carbon burned from 1800 or 1900° F. in small sections of wire, like No. 5 or 12 or smaller, you will produce martensite. But a normal patenting operation won't get through any of those drastic quenches. The Trauwood process can plunge you into a drastic quench darned easily, that is the only thing. But I am not using that as a condemnation of the Trauwood process. It is one of the things that we have to control, but it is controllable. But I think the fact that in the case of the lead patenting, we exercise control of the AR-1 transformation and in air patenting we exercise control of AR-1.

Member: I wish Mr. Quatty were here who is the one who showed us how to patent, and all the wire that was patented by his method didn't make good wire, but he patented at very low temperature. He brought us a magnet and said, "When your wire is no longer magnetic, that is your temperature. The wire wouldn't stretch after that. We kept raising the temperature until it got close to 1750 or 1780 and the wire stretched down fine and we had very fine results.

Member: You are right at the optimum at 1800 and around there.

Member: We found when we lowered the lead and got the wire even at a little bit higher tensile that it would stretch still better and made wire which had better torsion and, we have found, had better fatigue properties. But we have also another difficulty in that the wire, as it comes down from the upper lead to the lower lead, comes down in ununiform temperature and has black spots and we just can't locate where it is. At the high temperatures we get more of it but at the lower temperatures we get black spots. We have wondered why. I hate to say this because no Trauwood man is here.

Member: How about the cleanliness of the stock?

Member: We cleaned it and put oil on it. We tried many different ways of cleaning the wire before it goes in. We tried various methods of drawing the wire. We tried lime coatings and we tried other coatings and we still get dark spots unless we go up to quite a high temperature, and even then we have a few.

Chairman McCarthy: Relative to your reference to the fact that there is nobody from the Trauwood process here, there isn't anybody here today; we don't have any open condemnation because we don't use it. We don't question but what it has an application in many cases. There are people—I don't know whether they are in the room now or not; I don't happen to see them—who will not offer as many compliments as some others will. The use of the process for fine sizes is more or less accepted, though. I don't think there is much question about that. The use of it for No. 5 rod and coarser patenting I don't think has been generally accepted. In that case, one of the reasons can be the economics of the thing. That is definitely in the picture. There is a certain question associated with everything we do and there is a cheaper way and more expensive way to do it. Now when you start talking about fine sizes of rope wire, you may well be in a position to use the lead quench anyhow. On the other hand, if you are talking about hard drawn spring wire, rod to size items, at .335 base, Pittsburgh, to be plain about it, you are not talking about the Trauwood process. That is my guess. Maybe somebody will contradict me on that.

Member: This was fine wire.

Chairman McCarthy: There is a field of application there. But the question remains as to whether it is better than the old lead quench or whether it isn't. That is the single lead I am thinking about, using the single lead, and which is the most economical. And I don't think that the use of the process has gone far enough for anybody today to make a general statement. It has some very unique features as regards the cold work characteristics in the material produced. A lead patented structure has always amazed me in contrast to some of the air patenting structures in its behavior in cold working, but it is a very interesting process and I think it has some definite possibilities.

As far as I am concerned, I have got to attend a luncheon tomorrow noon, so I am not helping this cause as far as getting through early. Would anybody else like to offer anything to this melting pot of patent processing? I see Dan Newman over there. He is an authority.

Mr. Newman: I am so confused now, Ben, I won't add any further comments.

Chairman McCarthy: Well, it is just 12 o'clock. We have done a good job and I would personally like to express appreciation for the turnout of very competent metallurgists whom we have with us today. I may be taking on myself the thing that you would honor us by coming here, but you certainly have lent an awful lot to this discussion and I appreciate it very much. If there is nothing further, I think we should stand adjourned.

. . . Recessed at 12 Noon . . .

Meeting, Tuesday, October 16 — 1:30 P.M.

Chairman of Meeting

L. D. Seymour,
Manufacturing Manager,
Rope and Wire Fabrics Division
John A. Roebling's Sons Co.
Roebling, N. J.

Annealing High Carbon Wire Stock
by J. H. Loux, Engineer,
Salem Engineering Co.,
Salem, Ohio
Published
October, 1945
Page 742

Herman Galvanizing Process
by Rowland Hussey, Supt. Wire Dept.,
Jones & Laughlin Steel Corp.,
Aliquippa, Pa.
Published
December, 1945
Page 927

PAPER: Annealing High Carbon Wire Stock

Written Discussion Presented By
J. L. Whitten, Sales Manager,
Lee-Wilson Engineering Co., Inc.,
Cleveland, Ohio

THE article just presented has been given a thorough study and, as we have been asked to discuss it, we are making the following comments.

✦ ✦ ✦

WHILE we do not know the plant at which the practice described was developed, it is indicated that it is being done with direct-fired furnaces with sand sealed inner covers and with the Salem Engineering Company's type of generator with hot purging gas. It is further indicated that the material being worked on, while at times called tool steel, is still low enough in chrome, nickel and molybdenum content that it can be pickled before annealing. The ordinary or standard tool steels are usually too brittle to pickle before annealing and have to be annealed with the scale on them, which presents an entirely different atmosphere problem. On these materials considerable success has been obtained in radiant tube fired gas tight furnaces, without atmosphere, but using enough dried charcoal to quickly absorb the oxygen in the chamber before decarburization could be accomplished. A slight degree of further scaling results, but the decarburization has been limited to one or two thousandths.

✦ ✦ ✦

ON the other materials which can be pickled before annealing, and particularly on 52100 ball bearing steel, an exceptionally fine job has been done with Monogas or dry nitrogen atmospheres, which has the further advantage of being non-explosive and non-combustible.

✦ ✦ ✦

WE should like to place a great deal more emphasis on the furnace design as contributing to the final results. A radiant tube fired furnace with an oil seal inner cover and with an alloy cover over the base to separate the brick work from the charge, eliminates all of the necessity for protection against explosion, hot purging, and in addition provides better overall furnace for furnace maintenance and heat application.

✦ ✦ ✦

THE very fact that the furnace described in the paper is direct-fired will of necessity force the use of an explosive gas, fairly high in hydrogen, because the products of combustion on the outside of the inner cover will enter the inner cover through the sand seal by partial pressure exchange regardless of the fact that the gas flow is outward. In the products of combustion there is a partial pressure of 2.3# of CO_2 and 1.8# of H_2O (partial of the total of 14.7# of atmospheric pressure). With a nitrogen atmosphere in use, under the inner cover there will be 0# partial pressure of CO_2 and 0.0015# pressure of water vapor in the dried gas.

✦ ✦ ✦

THEREFORE, in a sand sealed inner cover there is practically no resistance against the entrance of these two gases, and of necessity a gas must be used with a high hydrogen content and high CO content to establish an equilibrium with the CO_2 and H_2O which enter. It is this fact that necessitates the use of methane or some other doctoring influence in nitrogen gas in a furnace using a sand sealed inner cover. But, if the inner cover is oil sealed, all of these problems are removed and a gas of nne analysis can be used, that is, nitrogen, with 5 to 6% combustibles, for all analyses of steel, and the critical supervision that is mentioned for controlling the input of the methane is not necessary.

✦ ✦ ✦

THE mention just made previously of the transfer of gases by partial pressure is explained simply by referring to the old experiment in the physics or chemical laboratory in which two bottles, one containing only oxygen, and the other only hydrogen, were connected by tubing and left to stand overnight. The next day the class determines that both bottles contain a complete uniform mixture in the same percentages of oxygen and hydrogen, although there was no effort made to direct the flow in either direction.

✦ ✦ ✦

A COMPLETE engineering study of this partial pressure exchange in annealing furnace chambers is presented as follows:

(Analysis Shows Necessity of Radiant Heat Application for Sand Sealed Inner Covers Using Monogas Atmosphere (Dry Nitrogen).

Analysis Shows Necessity of Radiant Heat Application for Sand Sealed Furnaces Using Monogas Atmosphere

Calculation of Partial Pressures of Constituents of Products of Combustion of Natural Gas.

1# of natural gas combines with 17,265# of air

Products of combustion per pound of gas and 17.265# of air

2.744# CO_2
2.246# H_2O
13.275# N_2

18.265#

Partial pressure absolute of CO_2

$\frac{2.744}{18.265} \times 14.7\#\ PSI = 2.28\ PSI$

Partial pressure absolute of H_2O

$\frac{2.246}{18.265} \times 14.7\#\ PSI = 1.81\ PSI$

Partial pressure absolute of N_2

$\frac{13.275}{18.265} \times 14.7\#\ PSI = 10.71\ PSI$

Calculation of partial pressures of constituents of monogas (nitrogen) atmosphere.

Analysis of gas at -40° F dewpoint by volume

94% N_2
3% H_2
3% CO

plus .05 grains of water per cu. ft.

Weight of nitrogen grains per cu. ft. standard conditions = 7000 x .07439 =

510.73000

Weight of H_2 grains per cu. ft. standard conditions = 7000 x .005327 =

36.289000

Weight of CO grains per cu. ft. standard conditions = 7000 x .07404 =

518.28000

Weight of .94 cu. ft. of nitrogen	480. grains
" of .03 cu. ft. of hydrogen	1. grains
" of .03 cu. ft. of carbon monoxide	15. grains
" of water	.05 grains
	496.05

Partial pressure of N_2

$\frac{480}{496} \times 14.7 = 14.2\ PSI,$

Partial pressure of H_2

$\frac{1}{496} \times 14.7 = .03\ PSI$

Partial pressure of CO

$\frac{15}{496} \times 14.7 = .45\ PSI$

Partial pressure of H_2O

$\frac{.05}{496} \times 14.7 = .0015\ PSI$

In describing a 1 to 1-1/4# H_2O differential, we assumed that there might be as much as 20% excess air.

For a direct fired furnace with sand seals, partial pressure exchange will take place as follows, regardless of outward velocity of gas leakage through sand seal.

Gas	Combustion Chamber	Under Inner Cover
CO_2	2.28 →	0
H_2O	1.81 →	.0015
N_2	10.71	← 14.2

THE analysis is made on the basis of using natural gas but essentially it is correct for any kind of fuel.

✦ ✦ ✦

IN the Lee Wilson furnaces at one of the eastern wire mills, hundreds of tons of #52100 ball bearing wire and rod have been annealed in the monogas atmosphere with such excellent results that the metallurgists of the company which supplied the raw material stated that the finished product was better than they made in their own plant.

✦ ✦ ✦

THE results of the use of nitrogen gas with #52100 and other alloy steels at other plants were equally satisfactory. The results of this process are recorded in Mr. J. L. Kozma's article in WIRE & WIRE PRODUCTS of April 1944 under the subject "Decarburization Control with Nitrogen Gas Atmosphere in Alloy Steel Annealing."

✦ ✦ ✦

IT is a simple process to anneal the steel in monogas atmosphere and check the dewpoint and gas analysis at 1000° F. before decarburization can occur; and, then if everything is all right, allow the cycle to proceed on upward into the spheroidizing range with the knowledge that the results will be entirely satisfactory. The material in an oil sealed base with an alloy base cover is in effect in a metal can, and with radiant tube heating we know that the inner covers are not subject to localized hot spots with a chance of cracking early in their tour of duty.

✦ ✦ ✦

A LEAK in the inner cover is just as bad as a leak in the sand seal because during some portion of the cooling cycle it is quite likely that a negative pressure will exist which will pull in air through any opening. This can be guarded against by cautioning against raising the furnace bell too fast, and also by shutting off the exhaust atmosphere line and opening up the large purging orifice to the base whenever the furnace is going to be removed.

✦ ✦ ✦

IT is our belief that the method here described is the most modern, will require the least supervision, and provide the best overall engineered

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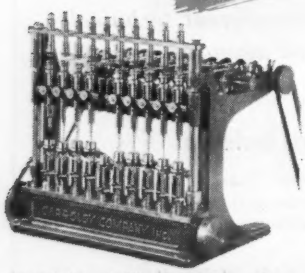

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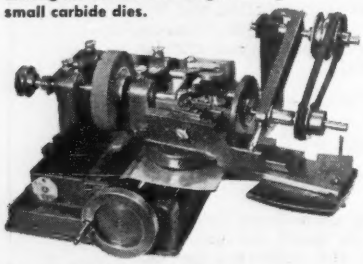

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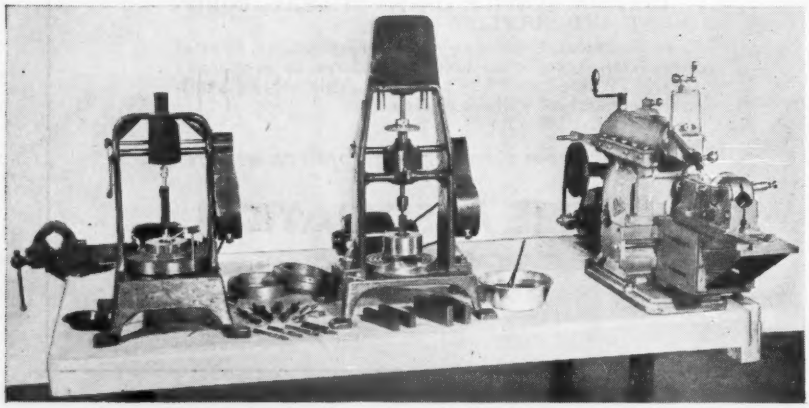

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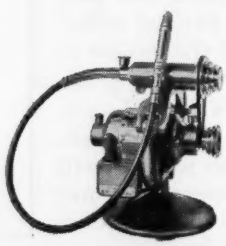

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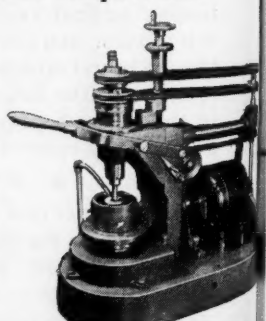

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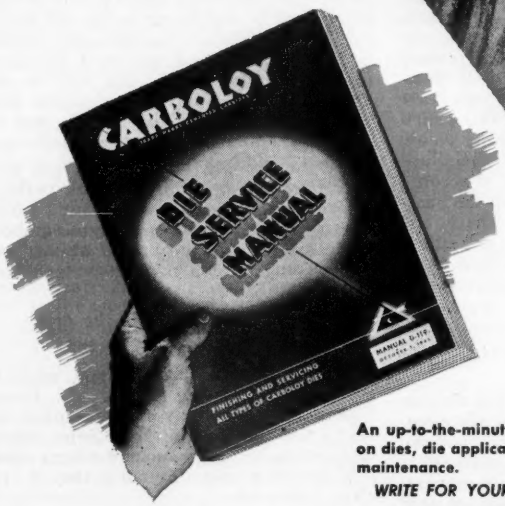

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application of furnace and gas equipment to the process of annealing alloy steels without decarburization. The only criticism offered is that the article infers that the type of gas described is the only one that will do this job correctly; so, we offer the idea that a better furnace design combined with a safer and less critical gas will give the same results with much less supervision, and, incidentally, at a lower fuel cost, and a much lower maintenance cost.

WE are of the opinion that the alloy steel industry, particularly the tool steel manufacturers, could well use improved annealing equipment for processing their material. The necessity for spheroidizing tremendous quantities of bullet core material during the war has made a lot of these people familiar with the process because the bullet core material was essentially a tool steel, as its molybdenum content varied between 0.85 and 1.15. The mystery has been removed and therefore the reluctance to change should disappear and the industry benefit as a result.

✦ ✦ ✦

WE believe Mr. Loux's article is going to stir up some interest in this phase of wire manufacture, and of course that is the most useful result of these efforts to educate the industry.

Reply to Written Discussion
By J. H. Loux, Engineer,
Salem Engineering Company
Salem, Ohio

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1. The assumption is correct that the annealed material we described was low alloy high carbon tool grades. But the assumption is **not** correct that all materials were pickled before annealing. Most of the microphotos shown in the paper were of steel annealed directly off the mill. The results were: no additional scale and ½ thousandth additional decarb.

✦ ✦ ✦

2. The statement that a direct fired furnace requires the use of a high H_2 and high CO atmosphere or a so-called "doctored" nitrogen atmosphere because of the partial pressures of the products of combustion is not necessarily correct. The case referred to in our paper where Methane addition was required in a nitrogen atmosphere involved the use of a radiant tube fired furnace where these pressures did not exist.

✦ ✦ ✦

3. With the furnace equipment described in this paper the operating technique that we have always recommended is that full manifold pressure of from 2 to 4″ water column be maintained on the inside of the inner cover at all times during the soaking and the cooling cycle.

✦ ✦ ✦

THIS is accomplished by closing the atmosphere exhaust valve from the base. There is then an ample supply of gas available to cover the diffusion of gas through the sand seal or through any leaks that may have developed.

✦ ✦ ✦

THIS procedure eliminates any possibility of a negative pressure existing at any time during the entire heating, soaking and cooling operation.

ORAL DISCUSSION:

The Tuesday Afternoon Session was called to order at 1:55 o'clock, Mr. L. D. Seymour presiding.

Chairman Seymour: I guess we had better get moving along. The meeting is a little late in getting started. We were a bit late this morning.

The first paper this afternoon is "Annealing High Carbon Wire Stock," by Mr. J. H. Loux, Engineer, Salem Engineering Company, Salem, Ohio. Mr. Loux, take over.

. . . Mr. Loux abstracted his paper . . . [Applause]

Chairman Seymour: I think the value that is obtained from these annual meetings of The Wire Association is probably due to the discussions which follow a paper such as Mr. Loux has just given you, and the Program Committee this year sent out some of these papers and asked people if they would be willing to make written discussions to be given at the meeting. I believe Mr. Whitten of the Lee Wilson Engineering Company has consented to give a written discussion on that and I will call on Mr. Whitten now, before we start the general discussion, to give that discussion.

. . . Mr. Whitten read his written discussion . . .

Chairman Seymour: We have heard two divergent opinions on the use of atmosphere gas in annealing high carbon wire. How about throwing the meeting open to discussion and you fellows who use these furnaces and have some things that you want to do and accomplish, tell these fellows what you want. I now throw this meeting open to discussion of this paper and let's see if we can have some views from the operating people or metallurgists as to what they would like to accomplish in this postwar period with the business that is available. Or, if there are any questions you would like to ask either of Mr. Loux or Mr. Whitten, I think they would both be very glad to answer them.

Member: Can you use bone dry nitrogen without a drier and get results?

Chairman Seymour: Mr. Whitten, do you want to answer that?

Mr. Whitten: It is our opinion that it isn't possible to use bone dry nitrogen as an atmosphere to prevent decarburization. The nitrogen itself will not be a decarburizing agent but it will not prevent carbon migration from the body of the steel when the material is heated. It is necessary to have some stabilizing agent in a gas in the form of carbon monoxide to establish an equilibrium against carbon migration. If there isn't a stabilizing agent in the atmosphere, the carbon at the surface of the steel will continue to leave it as the heating process goes on. The proper percentage of stabilizing agent will establish an equilibrium against this migration. We have found that it is necessary to have approximately 3% CO in the atmosphere to do this and of course with the 3% CO will be found 3% H_2, and all of the CO_2 must be stripped from the gas.

Mr. Lewis: Mr. Chairman, I got here late, I am ashamed to say, and perhaps this matter has been covered, but I would like to ask if Mr. Loux said anything about the possibility of the use of atmosphere in restoring carbon previously lost from the surface of the steel?

Chairman Seymour: Yes, he did.

Mr. Loux: That was covered.

Chairman Seymour: Do you want to enlarge on that any more, Mr. Loux? There seems to be some argument between the various operators. Some operators put carbon back on and others claim it is simply a migration. But they do reclaim material.

Mr. Lewis: I have heard still another version, that it can be done but it takes a college professor at the valves to regulate the job properly, to avoid over-carburizing the surface. Aren't there some users of that atmosphere here who could give us some information?

Chairman Seymour: Could some of our metallurgical friends explain it in such language so we operating fellows can understand what the possibilities are of putting the carbon in or taking it out, whether it comes from the outside or migrates?

Member: We have used Salem pits and anneal high-speed steel and put carburizing compound in to balance. You put a certain amount of carburizing material in the pit when you are annealing to balance what you lose.

Mr. Whitten: In discussing the question of adding carburizing compounds to replace the carbon in the surface of the steel, it must be remembered that if the annealing temperature is under the lower critical point, the material is not hot enough to carburize. In certain tool steels the annealing temperature may reach a carburizing level, but it is our opinion that it would be very difficult to control a process requiring long cycles for spheroidizing or annealing and control the carbon input. Anyway, very few of the steel annealing temperatures are in the carburizing range.

In the particular article referred to, that is, Mr. J. L. Kozma's article which appeared in the April 1944 issue of WIRE AND WIRE PRODUCTS and entitled "Decarburization Control with Nitrogen Gas Atmosphere in Alloy Steel Annealing," an illustration appears which shows how a band of free ferrite looks in the steel sample before annealing and how this has been replaced with migrated carbon at the end of the annealing cycle in which the temperature was not high enough to carburize the sample.

I think Mr. Kozma of our company, who conducted a great many of these tests with nitrogen gas on alloy steels, might have some interesting comments to indicate what control is exerted over the process in doing this particular work.

Mr. Kozma: I might add a few words to the discussion as to the possibility of using bottled nitrogen gas and still preventing decarburization. As Mr. Loux mentioned in his paper, nitrogen is considered a non-reactive gas. However, a non-reactive gas will not prevent decarburization, although it may not cause any either. The reason that we cannot consider Monogas an inert gas or a non-reactive gas is that about 3% of CO and about 3% of H_2 are constituents, and both CO and hydrogen are reducing gases. It is this 3% of CO that maintains the carbon in the surface at equilibrium.

Upon the subject of carbon migration that has entered into the discussion, studies and experiences indicate that carbon does migrate from the inner section, or core, to the surface, and the gas that surrounds the surface of the wire holds the carbon at the surface and prevents it from entirely leaving the steel, providing it is of equilibrium at the annealing temperature. On one test, several examples were taken of alloy or high carbon bar material, which was turned entirely free of the existing decarburized surface. These pieces were annealed in an atmosphere which we believed to be above carbon equilibrium to the steel, and above normal annealing temperature.

After annealing, the sample, through a surface thickness of a few thousandths of an inch, was found by chemical analysis to be slightly higher in percentage of carbon content than the inner core section. This substantiates the fact that carbon diffusion can take place inwardly, provided that the atmosphere is above the carbon equilibrium to the steel and at temperatures high enough and periods of time long enough to carry out such a process. This process and condition is frequently called "carbon restoration."

We find Monogas atmosphere equipment to be quite flexible in operation. While it may take a college professor to give the proper answers and discussions on questions as to whether it is carbon migration or carbon restoration to the surface which eliminates the free ferrite area on the surface of the steel, we feel that the equipment and process is quite simple, when a standard practice is set up. Small variations in the percentages of gas constituents will not have any marked effect upon the steel.

Member: Mr. Chairman, some of us were probably prepared to discuss Mr. Loux' paper, but I don't believe we were prepared to be able to discuss the discussion on the paper. The discussion on the paper raises considerable of a controversial question. This entire matter of producing prepared atmosphere is still undecided. You will find about as many operators having different views. Nothing was brought up about what people do when they have coking gas and have no natural gas at all. Now it is coking gas with sulphur. Now they have to do many things, yet they prepare a gas with no CO_2 at all in it and in the end it is practically nitrogen and a little hydrogen and some CO. Therefore, you can't lay down a hard and fast rule as to what percentage of CO there would be or was likely. I had a question in Chicago one time. Somebody said that 8% is bad and 4% is not so bad. I said, "Well, if 8% is bad and 4% is not so bad, let's take it all out." Many people use prepared atmosphere and don't use any CO_2 gas. They use CO_2 solvent. Now, whether it is to be frozen 40 minors or 50 or 20 minors, that depends upon the type of operation or plant that you have. Therefore, you can't lay down a hard and fast rule.

Now some of the questions brought up by the discusser of the paper, that is a question that no one has been able to decide the merits of, direct fired or tube fired. I don't believe that part had any room in this paper or discussion of the paper. I think Mr. Loux prepared a paper and I couldn't find anything wrong with it merely to show that there is a great deal of thought being given to this whole subject and the subject is under deep study and the fact there is a realization upon the part of operators that you have to do many a thing in order to get certain results. Also, that a furnace is a very important tool of production, it is not just a mass of brick. We hope that even five years from now or ten years from now there will be many subjects that will be undecided, but in the meantime the art is making a great deal of progress and we are all going forward and I think Mr. Loux did a very nice job in presenting the paper.

Chairman Seymour: I believe Mr. Loux mentioned the fact that some people had been working trying to cut down the annealing cycle on spheroidizing high carbon. How about hearing from some of you fellows who tried some of those things and letting us know what the results are? I think I see a couple of faces who could talk. I don't believe it is any state secret. It is one of those things which is in the text book but which somehow or other the people hadn't thought that the furnaces they had could do them. Referring to the up and down through the critical range, I believe there are some people who have done that and have cut some time off their annealing cycle.

Dr. Braley: Mr. Chairman, we have had a lot of discussion here and I have heard college professors mentioned two or three times, etc., in discussing problems of equilibrium, thermodynamics, heat of reaction, free energy, from a practical standpoint without considering the basic facts upon which it is placed. It is possible to take a uniform gas and as your temperature goes up, carburize at one temperature and decarburize at another. In one case, that range will come at a different place with one steel than it does with another.

Now there has been a lot of theoretical work done on this type of thing. As far as I see it, it is a matter of application of the particular job at hand and unless everyone is agreeable operating under exactly the same conditions and the same type of gas and the same steel, why, you are going to have variable factors that you are going to have to work out with the individual.

Now you can go back to the heat of energy. That is the free energy involved in these reactions. And you can figure out the theoretical conditions under which these will work. Now there is one thing to consider a perfectly theoretical condition. Such things don't exist in the steel mills or any other commercial operation. Anyone who considers that you can work on that type of basis is out of place because you have got to take into account the variables and fluctuation of results which apply to any commercial operation. In other words, you can't run a commercial operation on a research basis. The research basis, of course, has to be run in absolute accuracy. In commercial operations, no. There are too many variables, changes and other conditions that affect us. As I see this, there is probably no one ultimate panacea for all of these ills. What you can do, depending upon the conditions under which you are operating, you can fluctuate the basic facts involved in the association of gases and even with reactions in between gases and solids.

Now we have been mentioning also about the migration of carbon, which is nothing more than the matter of convection in steel. We know that steel takes up carbon. You start with the material which is decarburized on the surface and keep it for a long time under any condition and you will get better distribution of carbon. If you start one whereby the uniform distribution will remain the same you will not build up carbon on the surface. Those are all purely basic facts but they have to be applied to the operation at hand.

Member: Mr. Chairman, while listening to this paper, I thought there were a few points I would like to have clarified. I heard them mentioned two or three times from the floor. Seems to me on the question as to whether we lose carbon or don't lose it, that ought to be a measurable quantity. But what have the furnace people done to measure that?

Chairman Seymour: Would anybody care to answer that?

Member: Mr. Whitten made a remark that was of interest to me. That is the use of charcoal inside the furnace. I would like to ask for some amplification of that

(Please turn to page 94)

Chairman Seymour: Any further questions or discussion anyone can add to this subject? If not, we will move along. The next paper on the program this afternoon is on Herman Galvanizing Process by Rowland Hussey of the Jones & Laughlin Steel Corporation. I believe that the hot galvanizing process is one of the oldest processes in the wire industry and there has not been much change made in the conventional method up to the time that the Herman Galvanizing process was introduced. So I think it is with a great deal of interest that we will ask Mr. Hussey to tell us more about the Herman Galvanizing Process.

. . . Mr. Hussey abstracted his paper. [Applause]

Chairman Seymour: I think we have all enjoyed very much Mr. Hussey's fine paper on the Herman Process. I believe there are several installations and perhaps there are some people here who would like to ask some questions. If so, now is your chance to ask them.

Member: Mr. Chairman, I have no question on the process itself, but it would be rather interesting to me to know just how the strands of wire are threaded through it. That wasn't quite clear in Mr. Hussey's explanation. Is that top lifted off enmass and the various strands of wire threaded through it before they are hot or is the wire threaded through the molten smelter and up through these various nozzles?

Mr. Hussey: In starting off the frame from scratch, you might say, 36 pieces of wires are put down through the slots and around the roll and hitched to a little bar that we have welded on the back end of the machine and these wires are put in place before the machine is put into the spelter bath of the main tank, and then when the operators want to start it up or thread it up, they just connect wires onto both ends, one end going to the frame and the other end picking up the wires coming through the cleaning line. In the case of a broken wire during operations, they just fasten the broken one onto an adjacent wire, let it pull through and then push it in place with a little gig or a bar with a hook on it.

Chairman Seymour: Any other questions?

Mr. Lewis: Do I understand that this Herman machine can be readily removed? Do you customarily use a frame on Herman wire and then put the old sinker back on and run it with charcoal or wiped wire for a while?

Mr. Hussey: We don't run charcoal wire any more.

Mr. Lewis: I was wondering how long it took to get the machine on and off?

Mr. Hussey: The machine is readily lifted off with proper hoisting rigging overhead. In our case, we have another one standing by that has been reconditioned, threaded up with wire ends sticking out both sides of it, and from time to time we take one off, when we feel that the bearings are getting bad or some part needs some work done on it. We don't try to do anything on it in place, but lift one off and put another on and go to work again. We take a Herman machine off and very often change a frame over to Type 1 wire.

Mr. Lewis: About how long does it take to make a change-over?

Mr. Hussey: About a turn to get one taken off and another put in and running again.

Mr. Lewis: How about splices coming through?

Mr. Hussey: We don't weld. We knot and the knots go right through. There are clearances through the nozzle and up through the machine for knots to go through.

Chairman Seymour: Any other questions?

Member: You speak about the nozzle in that Herman machine. It is a slot clear across the machine, isn't it?

Mr. Hussey (pointing to a schematic diagram): That nozzle? That is the bottom plate of the Herman machine and here is the sinker roll, which is bracketed onto the machine, and right in line with that edge of the roll is the slot through which wires go up through. Now that nozzle I talk about is merely sides built up around the bottom slot. The impeller working to keep the level of the zinc down inside this chamber, reduced a quarter inch is enough, causes a flow of zinc to go up through and spill over the top of the nozzle.

Member: That slot runs all the way across.

Mr. Hussey: That slot runs all the way across to take the 36 wires.

Member: Is the machine made of sheet metal and how long does it take for it to dissolve, or until you have to build a new one?

Mr. Hussey: It is made of plate. The plate is about three-quarters of an inch thick and I suppose we have to renew some parts of that Herman machine about once in fifteen months, fifteen to eighteen months, something like that. I don't know the exact time. It is well over a year.

Mr. Lewis: That raises the question of dross. Is there any noticeable difference between the amount of dross you make with the Herman process?

Mr. Hussey: I can't say that there is.

Mr. Lewis: I know that your immersion is very short and I thought maybe there was less dross formation on the wire.

Mr. Hussey: There is possibly less dross coming from the wire but probably a little more from the walls of the main kettle because of necessity the kettle must be made larger than you need for charcoal process. You must have a considerably wider tank than you would otherwise need for 36 wires because the sinker roll bearings stick out a little bit on the side; that is, the bearings and the journals on either end of the roll, of course, take up some space. Those journals are about eight inches long.

Mr. Lewis: Your wires can't be spaced as close as they are on a charcoal job.

Mr. Hussey: Yes, they can be spaced as close.

Mr. Lewis: You need more space at the ends.

Mr. Hussey: You need more space at the end for the sinker roll journals sticking out beyond the two outside wires.

Mr. Lewis: How about the depth of the tank?

Mr. Hussey: The depth of the tank has got to be enough so that you have this dimension there (pointing to diagram) and something below it to keep the roll out of the accumulation of dross.

Mr. Lewis: What would you say it would be on the usual range of sizes?

Mr. Hussey: What is what on the usual range of sizes?

Mr. Lewis: The depth of the tank, a 30-inch tank?

Mr. Hussey: Yes, our tank is 30 inches deep. By reason of the great width of the tank you have got to have wall space in the tank to put quite a lot of heat into it and one way you can get wall space is to increase the depth.

Member: Side-fired tank?

Mr. Hussey: This is a side-fired tank. Both of these units are side-fired tanks.

Chairman Seymour: Is it true you can operate your spelter at slightly lower temperature than you do for your charcoal?

Mr. Hussey: I wouldn't say that is true.

Member: How is the heat consumption?

Mr. Hussey: Heat input for a ton of wire? I can't tell you for a fact, but due to the size of tank and the amount of metal in the tank, it is at a very uniform rate of flow of heat. The size of the tank and the mass of the metal in it tends to level out any fluctuations in heat input.

Member: Is it possible to tell the weight of the coating?

Mr. Hussey: Yes, within limits. It is possible to control it by varying the speed. Theoretically, the faster you run it, the heavier coating and actually the heavier the coating will be.

Mr. Lewis: How heavy have you operated it? How heavy a coating do you think it would be practical to put on, say, the usual fence sizes?

Mr. Hussey: Oh, we're not talking fence sizes.

Mr. Lewis: You are talking 9 or 10-gauge, or around there.

Mr. Hussey: We aim to keep the coating as light, yet stay in the Type 3 range, but on some playing around that we have done to see what speeds would do on 12-gauge wire, we have put on coating up to 1½ ounces.

Mr. Lewis: Did you run into any inconvenient speeds to get that?

Mr. Hussey: That wasn't an inconvenient speed. The only inconvenience it created was that it was using up too much zinc.

Mr. Lewis: How about the other end of the range? My recollection is that it isn't considered economical to go much below .6.

Mr. Hussey: Between .6 and .7.

Mr. Lewis: Can you actually put on .3 coating if you run slow enough?

Mr. Hussey: It sort of catches up with you. If you run slow enough to let the zinc drain with an idea of draining it to a thinner value, in the meantime you are building up the zinc alloy coating so you are sort of catching up with yourself there. Isn't that right, Garry?

Mr. Garrett: The slower you run, the heavier coating you get and the faster you run, the heavier coating you get; in between you have a happy medium.

Mr. Lewis: As I recall it, Joe Herman told me his range was from .6 to 2 ounces.

Mr. Hussey: That could readily be. That is right.

Member: Will the 1½-ounce coating on a 12-gauge wire stand forming?

Mr. Hussey: I don't know, Mr. Schueler, because we didn't do much playing around with it except to see what it would pick up when speed was changed. You could well surmise that there is a pretty high degree of purity of zinc on the outside when you were picking up that much and the zinc-iron alloy layer probably would be pretty thin or pretty small. Wouldn't that follow, Garry?

(Please turn to page 97)

Meeting, Wednesday, October 17 — Morning Session, 10 A.M.

Chairman of Meeting

Kenneth B. Lewis,
Consulting Wire Mill Engineer,
Worcester, Mass.

Preparing Rod Surfaces for Drawing
by H. L. Trembicki, Manager,

Metal Coating Division
Magnus Chemical Company,
Cleveland, Ohio

Published
January, 1946
Page 38

PAPER: Preparing Rod Surfaces For Drawing

The session convened at ten o'clock, Mr. Kenneth B. Lewis (Consulting Wire Mill Engineer, Worcester, Mass.) presiding.

Chairman Lewis: The subject of the paper that will form the main part of this session was chosen as a result of quite a number of urgent requests.

The subject of preparing rod surfaces for drawing is about as fundamental as anything I can imagine in the wire industry. The paint manufacturers, you know, have a slogan, "Save the surface, and you save all." I can't imagine any place where that would be more true than in the wire industry because wire is practically nothing but surface. In fact, come to think it over, we never draw wire, strictly speaking; all we draw is the preparation on the surface, which Mr. Trembicki and some of the commentators are going to discuss this morning.

Really that is the job we do: We draw a film of soap, iron hydroxide, maybe lime —with due apologies to these gentlemen who think there is no lime or soon will not be. So I think it is fair to say that this is the deepest, most fundamental problem that has ever been tackled or discussed in the field of wire.

There was some question as to just how to get at it. Maybe a little historical background would not be out of order.

Up to something like a hundred years ago, I don't think there was anything used on wire. In fact, there wasn't any pickling of wire. That is quite definite. The wire rods were cleaned by scratching off the scale with old bricks and big pieces of leather impregnated with sand, and the lubricant, such as it was, had to get hold of that surface as best it could.

Of course, the drafts were extremely light, the pieces of wire were extremely small, and there is definite evidence that the resulting wire was of a simply frightful nature. It had no recognizable size. If it was round, that simply means that it came nearer to being round than any other recognized geometrical shape.

It was not until it came down to fine wire that anybody paid any attention to the surface because there was no market for coarse wire, no such thing as coarse wire as a saleable article. Coarse wire was nothing but a stage in the preparation of what was really considered wire, and that was the fine sizes. As a matter of fact, coarse wire wouldn't have been of much consequence because the pieces were too short; something under three or four pounds was a pretty good bundle of wire 150 years ago.

When attention did begin to be given to the preparation of surfaces, something like 150 years ago, lime, so far as I can make out, was the first used. I don't think it came in, in any way, as a neutralizer. As a matter of fact, the use of lime, I think, preceded the use of acid. I know that lime was in use about a hundred years ago in mills that had never used acid and never planned to use it.

It is between 95 and 100 years ago that Deacon Washburn, of my home town, Worcester, had quite a voluminous correspondence with old George Bedson, in Manchester, regarding their mutual problems as wire manufacturers. That was a period of sharp changes and advances in wire drawing practice.

Their correspondence, which of course necessarily in those old days was an exchange of handwritten letters, is not easy to follow because whichever end you are working from, you have only one set of letters; you can't see the answers. Mr. Bedson's letters are on file at the American Antiquarian Society at Worcester, and I suppose the others are on file at some antiquarian society in Manchester, but you can get quite a lot of information from hearing one side.

I recall that Deacon Washburn apparently had described to Mr. Bedson the new American practice of pickling rods in acid to get the scale off. Mr. Bedson wrote back, thanked him, and said that it was extremely interesting, but his interest was merely academic; on account of the cost of acid, if for no other reason, it was not a process that could ever be accepted in England. That was about 1850, but lime was being used at that time.

Old Nehemiah Highley, who died a few years ago in Pittsburgh at a ripe old age, somewhere in the nineties, I think, spent a good many hours telling me of his early days in the wire mills. His recollections went back to the time he was four years old when his grandfather used to take him out on the back of the pack ponies to scour the surrounding forest and pick up charcoal to bring in for the annealing. As soon as he could stand up straight, he was inducted into the mysteries of wire drawing in the mills.

Lime was in use when he came into the mill, about 1850. Acid had begun to creep in. At the plant where he worked, he said about half the rods were pickled and the other half were cleaned in the good, old, normal, conventional manner of that day of rolling them in a tumbling barrel with sand and water.

From time to time, he said, the cleaner would come in from the pickle house with an armful of wire rods. The scale on which operations were conducted at that time would permit a man to carry quite a supply of wire rods in his arms. The bundles ran up sometimes as high as 14 pounds; faggots, they called them.

He would come in from the pickle house with an armful of faggots,throw them on the mill floor, and say, "Share 'em up, boys," and the wire-drawers would scramble for them.Each man would get what he could, and each man had his own lime tub. One of the mysteries of the day was what was in the lime tub. Each man had his own tub, his own mixture.

What he had been able to get in the scramble, he would dip into the lime. If it was a nice, sunny, breezy day, as it usually was up there in the Malvern Hills in Wales, he would hang the faggots on a peg in the wall and let the sun and the wind do the baking.

So lime was definitely in at that time. In this country, for some reason unknown to me, lime lagged behind. There are people still in our Association, I am sure Clem McGowan is old enough, who remember the days before lime. I am not in that class myself; don't be deceived by the platinum blonde effect on top here.

When I first came into the wire industry, I was curious, as I always have been throughout my life, as to the history and the background of all these processes that I saw going on. I used to talk with old platinum blonde fellows, and they told me stories of the terrific struggle they had at the time the mill was shifted over to lime, as it had been on flour coat.

When I first came into the mills 40 years ago perhaps, as a mere child, of course, I remember that flour coat was still there. It was a ghastly thing, as some of you may remember. It was thick, funny-smelling coat of some low-grade flour. It was a brownish sort of thing, and it served the function that we have since alloted to lime.

Harold, I am sorry to be saying lime so much in view of what you may have in your mind, but I just felt that if lime was on its last legs, we might as well preach its funeral sermon. [Laughter] So I am going to refer from time to time to lime until you get up. After you get up, I suppose there will be no more lime.

This flour coat seemed to perform the function that we now like to think that lime performs, that is, it was a gatherer, a carrier for soap powder or grease. It had more or less the same characteristics. It got somewhat porous and rough on the surface so as to pick up soap powder. It bonded on the other side to the sull coat. In those days sull coat was a good deal more of a thing than it has come to be lately since carbide dies came in. Sometimes it was as thick as the plush on an old parlor sofa.

The flour coat did tie into that, and it went along, but it didn't go very far. The advantage, as I quickly discerned it there, was that if you wanted to draw

your wire a little way in soap, and then get rid of the soap and pop it into a wet drawing series, without an intermediate annealing, and pickling, you could wash off the flour coat.

Apparently there was no interchange or equilibrium, or whatever the chemists like to call it, which probably now results in the formation on our wire of a calcium stearate, which is insoluble in water. You couldn't have a flour stearate, so apparently the muck that was on the dry drawn wire of those days would wash off in water, and you could coat the wire with copper or tin-copper and go on down into fine wire nicely.

So we shouldn't regard lime as something sacred, something that has been handed down from the very earliest days. I don't think there is any mention of the use of lime in drawing wire in the Bible. I have always felt, and I have always said, that lime has its place, and it is an important place, but it occupies that place in the wire mill merely on sufferance. It is only there until we find something better.

You know I have never hesitated to stick out my neck in regard to these things. From time to time I have written articles and historical reviews, and I have committed myself to the belief that lime, important as it is and has been, is merely keeping a place warm for something better, which may or may not come along.

At the same time, as some of these wolves in the front row pointed out to me within the last two or three days, when I gave the Mordica Lecture a few years ago, I definitely predicted that lime was here for a long run. That is all right. I put my neck out, and it is still out. I stand on that prediction.

By the way, to get into the right frame of mind to participate in this discussion, we must not get it in our heads that the question before us is not merely whether or not lime is going to be retired in favor of something else. The entire subject of the preparation of the surface of steel wire for drawing is on the carpet. The elimination of lime and the substitution of something better is naturally a part of that picture, but it is not the whole picture.

The efforts to oust lime from its place have been frequent. In fact, they have been almost constant. When I came into the industry 40 years ago, the efforts were not only being made, but there was a history back of that.

I recall one of the first things I learned was about the salt-coat, so-called. That unsavory incident had recently passed into history, but the gossip still lingered on. Someone at the American Steel and Wire Company in Worcester, or perhaps it was Washburn & Moen at that time, had devised this salt coat. The details I never learned, and I didn't care a lot because it was such a flop.

It was marvelous for a while. They just dumped all the lime tubs and everybody felt that lime was finished. They made up a salt solution into which the wire was dipped and it was drawn with what we call today a black coat, that is, no vestige of any white on it. As the fellows said to me, it drew and drew and drew. There seemed to be no limit to the life of the coating.

I believe the patent attorneys snatched the thing up and rushed to Washington to be sure to get not only adequate protection but prompt protection because the news began to fly around like wildfire. They got some sort of coverage, and just about the time they returned in triumph with the papers, they found that the wire in the warehouse had rusted to pieces. It was a marvelous drawing compound, but like many others, it had a kickback.

Don't be discouraged, boys. This thing has happened over and over and will happen again, but some day somebody will get it.

I saw, 25 years ago, at least, alkaline substances other than salt, other than sodium chloride, other than the soda compounds, being used as a lime substitute and having a certain measure of success. They have come and gone. Each one of them has had its measure of success, and each one has eventually developed some fatal weakness, like that of the salt coat, or like that of a certain coat which I saw 10 or 15 years ago. It looked marvelous until the product was run through a tempering furnace, at which time the vestiges of the product remaining on the wire turned around and bored holes in it like termites. Each one has developed a weakness of that sort or, when sufficient work has been done on it to really get a cost run, it was found that by and large the thing with all its virtues cost too much.

We are now in a more active phase of the investigation of that subject than I have ever seen, not only more active but more scientific. The investigations of the past were of an empirical nature; the sort of thing where you go into the kitchen and take a little something out of every bin you can see and try this one and that one, with no particular idea in mind except to try everything.

But science makes advances. Scientists have crept into the wire business. We are having more chemists, more metallurgists, more physicists with us every day. It seems to me that efforts in that direction, in the direction of improving the preparation of the surface, are getting more intelligent all the time, and getting nearer the bull's eye.

Still, we are in a state of confusion now. There are perhaps five, six, or seven recognized new techniques in vogue, all tending in the same direction. Some of them involve the total suppression of lime, the substitution of something else; some of them involve the subordination of lime to some other medium.

As you wire men know, it is really a tough job to evaluate things of that sort. Not only is it difficult to interrupt production, particularly in times such as we have been passing through and are still passing through, in order to get adequate tests, but it is hard to get adequate tests which cover the field when the field is so large and is broadening so rapidly.

I think it is safe to say that a number of the men sitting here have tried these new surface preparations. Some of them have tried several. It is probably safe to say that no trial has been made without a certain measure of success. It is probably safe to say that some mills have found one material which they are quite certain will do a large proportion of their work satisfactorily. The experiences range all the way, probably, from total failure and complete disgust with the whole subject to a complete acceptance of one of the materials and a complete shift of mill practice to it.

It was with an eye to that confused situation that we decided to try this experimental session. Eventually, of course, we will all come to have a common pool of knowledge about these things, but it takes a long time. This is an effort to short-circuit the process and bring it to the point where, instead of two mill superintendents or mill foremen talking to each other and sharing their experiences over in a corner, each one will share his experiences so far as they are clear in his mind and so far as he is able to interpret them, with all of us.

Perhaps as an ideal we might, right in this room today, get ourselves two or three years ahead on this extremely important matter.

When the subject was broached at the directors' meeting, there came the question, how will we do this? Of course, we can get someone to write a paper. One of the engineers or chemists or salesmen who are promoting one of these things will be glad to write a paper and present it.

But one of the directors tossed in the idea that what we need on a subject of this sort is a symposium. He mentioned the Town Meeting of the Air. I suppose some of you have as much fun listening to that as I do. The moderator calls on five or six different people to express their views on a broad subject and gives each a chance for rebuttal, in so far as his remarks have been contradicted by another speaker. Then the audience participates and directs questions to one or the other.

There was a good deal of argument among the directors as to whether this sort of discussion was a proper thing for this Association; whether discussion of this sort would be fruitful or degenerate into nothing but sort of a name-calling and hair-pulling affair. There was much discussion and many opinions and modifications of the method of conducting such a meeting, but the idea seemed to run through the board of directors all the time that it would be a very nice thing if it could be properly handled, and it might lead the way to similar treatment of other subjects of broad, general interest and of controversial nature.

We are groping our way in respect to the method of presenting this subject. At any rate, there is one sure and simple way to present it, and that is to have one man get up and read one paper and express one man's ideas as to the state of the art. That we decided to do.

Mr. Trembicki, whose name and face are probably familiar to most of you, consented to present a paper—not in any way a deep research, nothing profound, nothing final, but something merely calculated to throw the subject open for general discussion.

Mr. Trembicki, will you read your paper to us, please?

. . . Mr. H. L. Trembicki (Magnus Chemical Company, Cleveland, Ohio) read his paper on "Preparing Rod Surfaces for Drawing." . . .

Chairman Lewis: Thank you very much, Harold. The discussion of this topic, we agreed among the directors, might very well be carried on or started off in a slightly different way from the orthodox. Mr. Trembicki is only one of many engineers who have worked and are working on this problem and who have had a measurable degree of success.

I haven't the faintest doubt that there are men sitting before me here, and some of them right up in the front row, who are firmly convinced that, although they may be too shy to say it, they and they alone hold the secret; that they have the only reliable product, the only technique and procedure along this line which has a future. There are probably people here who believe that they originated the whole subject.

I would like to call on some of these men to comment, not merely on Mr. Trembicki's paper, and not particularly

perhaps with a view to Mr. Trembicki's product or with the purpose of rebutting or disproving any of his remarks, although I don't want to limit them in any way.

Some of the directors felt that people in such a highly competitive position with each other couldn't discuss their common problem in a temperate way. I don't believe that. After all, all these fellows are salesmen in a way; and salesmen have brains, I know. I used to be one myself. I believe it is perfectly possible, even for the people sitting here, to contradict Mr. Trembicki in a nice way.

At any rate, I would like to hear from some of the experts before the general discussion. I see a number of them here. I probably don't see them all. If anyone connected with the production or sale or distribution of any of these products of this general nature wants to say something, and I don't catch his eye and call on him, I hope he will get up and introduce himself.

Floyd Hauger, what ideas would you like to contribute to this symposium on the general subject?

Mr. Floyd Hauger (Standard Industrial Compounds Co., Chicago): I think I agree with Mr. Trembicki that lime still has a place, and coatings so far are only taking certain special finishes where it is desired by the wire mill man.

Of course, another saving enters into the fact of the coating, and that is that we have no baking, which means that any wire mill may save from six to eight cents a ton right on their fuel cost without extra handling, and so forth.

I might go a little further and say that the best results of coatings, I think, are not yet obtained because we feel that special lubricants must be developed to go hand in hand with the coating. Whether those have been fully developed yet or not, I wouldn't say. We don't think they have been. But we think we are making a lot of progress in developing the coatings and also in developing lubricants to go with them for all types of finishes.

Chairman Lewis: Thank you, Floyd. You have disquieted me considerable. Harold mentioned the fact, and you seemed to emphasize it, that the baker is also on its way to join the dodo and the lime vat. Am I standing here and cutting my own throat? I own a patent on a flash baker, you know.

Mr. Richards, of Apex, will you comment?

Mr. John H. Richards, Jr. (Apex Alkali Products Co., Philadelphia): I would like to take this opportunity to congratulate my worthy competitor up there on a well prepared and well delivered paper.

Maybe I could save some of you fellows the trouble of going through something that we did. The idea occurred to us that you can't fool everyone all the time, and the coating compounds have been in existence sufficiently long now that probably the wire mills themselves have found out which is the better one.

So we compiled a list of the mills using coating compounds. Of course, we first made the list up of those using our coating compound. Then to that we added a list of mills using our competitors' coating compounds, or as nearly as we could make such a list.

Unfortunately, when we totaled it up, we had approximately 30 more wire mills than there are in the United States, so we started over again. We thought maybe we had been too optimistic in our own list, so we chopped off from our own list those mills which our competitors claim they are selling rather than us, and that left us with a zero number of customers. So don't bother to go through that because you can't get anywhere.

I would like to add this fact: Right now when most mills are afraid of demands for increased rates, I know one specific mill where, after the introduction of a coating compound, cleaning house rates were reduced exactly ten per cent. That has been within the past six months when there has been unusual agitation for more money for less work. One of the representatives from that mill is here today, so I am not afraid of being argued with on that point.

That is all I have to offer.

Chairman Lewis: Thank you, Mr. Richards.

I heard the other day that our old friend, Van Miller, had been toying with this subject and had a compound of some sort. It wasn't explained to me exactly what it was or for what purpose. I met Van's chemist here the other day, Mr. Smigel. If he is here, perhaps he will toss in an idea.

Mr. Walter Smigel (R. H. Miller Co., Inc., Homer, N. Y.): Our experience on coating compounds has been rather limited. We started our research about a year ago. I don't think that we have anything concrete to add to what has been said. Our results so far have been gratifying, but we don't think we have the final answer.

I believe the lubricant, as pointed out, is very important and, as you operating men realize, very lean lubricant is desired. This might be accomplished by the addition of lime to your regular lubricant, but I think that one in which the lime or other fillers are in solid solution is better because it increases the melting point of the lubricant, makes it more tenacious, helps it to carry through. I think that most of the coatings do not have the ability of lime to pick up the dry lubricant.

That is about all I have to say.

Chairman Lewis: Thank you, Mr. Smigel. I have heard lime mentioned here a number of times this morning, and I have heard a mention of lean lubricants. If I am not mistaken, when a man refers to a lean lubricant, he means a box full of soap which has been let down by the addition of lime. Is that what you had in your mind, Harold?

Mr. Trembicki: Well, yes, that is right. But I mean on these coatings, doing it in a very simple way, any lubricant that is slippery in the fingers is no good for them. It has to be a gritty one, no matter how fine it is ground; an absolutely dry, gritty lubricant.

Chairman Lewis: Do you think in that connection that the use of lime as an addition to fresh soap is of value as a drying agent? It always seemed to me that when there is difficulty with soap in the box, the difficulty generally arises from the fact that there is too much moisture in the soap, and lime stirred up with it will pick up that moisture.

Am I right? Have I the germ of an idea there?

Mr. Trembicki: Yes, you are right. You have to be very careful that the lime is absolutely dry. A lot of mills dry the lime as it is used in the box. But I do believe that we need to get to the point where a mill does have special lubricant for that type of drawing; that is, use the lime in there as a part of the composition of the lubricant.

Chairman Lewis: Ham, you might make a note of the fact that when you are no longer able to sell lime in a cleaning house, you can get rid of a little bit of it in the wire room.

Van Smith, of Oakite, is here. I wish we could hear from him.

Mr. Van Dorn C. Smith (Oakite Products, Inc., New York): So far the board of directors must be very pleased that nobody has taken exception to anything that anybody has said. I don't like to be the one who changes the precedent, but we have worked with these materials, and in working with materials on the alkaline side, we don't believe you can eliminate the hydrogen enbrittlement by a three minute boil in an alkaline solution. The best we have felt you could do was to cut the time of the bakers about in half, if you are willing to spend ten minutes in an alkaline solution between times.

That is the one thing I would feel is questionable in what Mr. Trembicki and Floyd Hauger have said. Our approach to this thing has been from a different angle than that expressed by Harold's paper. His idea is that you stay on the alkaline side, and our idea is that you stay over on the acid side.

When you apply an alkaline material, that has no action on the steel. It doesn't react with the steel, so when you withdraw your solution, you have it coated with whatever was in the water, and the water evaporates and leaves a uniform coating on the steel.

In working with acids, and we have worked with phosphates, you get an actual chemical reaction between the steel and the wire which results in the formation of a salt. That is chemically bonded to the underlying steel, and we believe you can get something which will stay on longer and better, and impose a layer of dissimilar hardness between the steel and the die better by doing that.

In our work we have not attempted to eliminate lime. We have simply gone along with the lime. That is, we go through the usual practice of pickle, rinse, dip in phosphate solution, develop your phosphate coating. You can rinse again, if you want to, but you don't have to. Then we go into our lime. We can't reduce the lime by having this other coating. You can usually cut the concentration of the lime to a certain extent, and then you have to go into a baker in the usual manner to eliminate the hydrogen embrittlement.

Now, that doesn't seem to offer the same type of thing which would be offered if you totally eliminate lime, but it works very satisfactorily, and we have a number of customers who are getting very good die life and who also have been able to get substantially more drafts than they have been able to get when they were using lime.

One instance that I have in mind, as an illustration, they were drawing wire about five holes; then recleaning it and drawing it on from there. That meant handling about 80,000 pounds of wire a day back through a cleaning operation. By the introduction of the phosphate coating, they were able to go down to the size they were after with the one cleaning.

It seems to me that that is the thing which may offer the best hope of improvement; not the elimination of lime, but to have something which works with lime and gives you more drafts of better quality.

Chairman Lewis: Thanks, Van. I thought that was very interesting. I gather that this is actually phosphoric acid. No? You would get that same result, though, by merely pickling in phosphoric instead of sulphuric acid?

Mr. Smith: No, you can't develop a suit-

able coating and have the phosphoric acid alone. It has a pH of about 2½ and the material we use has a pH of about 5.2, which is substantially higher.

The phosphoric acid, you might express it this way: You develop a phosphate coating, but the further action of phosphoric acid would then remove the phosphate coating which you had developed. It is just too strong to do it. You have to get up the scale in order to get a film which will develop and which will stay on there.

Chairman Lewis: You know sull coat is nothing but ferrous hydroxide or ferric hydroxide, a decomposition product of the steel surface on which it grows. It is that fact, the fact that the sull coat is growing out of and is a part of the steel that gives it value to us. It is the only key that we have to keep the terrific pressures of the die from simply squirting the coating right off of the wire.

Maybe I am wandering from the subject, but let me wander a minute. Phosphoric acid, which we know very little about because of its higher cost, is extremely like sulphuric acid. Phosphorous and sulphur are very much alike. The two acids are very much alike. It wouldn't take very much of a shift in prices to ditch sulphuric acid, the way Ham's lime is going, and substitute phosphoric acid.

In that way wouldn't we get a phosphate sull coat and approximate what we are getting now?

Mr. Smith: This goes back to another thing, and that is that the purpose of the sulphuric acid is to remove the blue mill scale. That is a mixture of Fe 203 and Fe 304. Phosphoric acid won't do that, so you would still have to use sulphuric acid.

Chairman Lewis: How do you know it won't?

Mr. Smith: Maybe I talk too fast. It won't do it on a cost basis that is comparable.

Chairman Lewis: That is because of the relative cost at present of the two acids. Remember, I said assuming there was a change.

Mr. Smith: Yes, that is right.

Chairman Lewis: If you are going to say that phosphoric acid won't react on those scales the way sulphuric acid does, I don't think sulphuric acid does anything of consequence to the scale. The heat cracks the scale, and the acid crawls under and washes it off. Wouldn't phosphoric acid do that?

Mr. Smith: I think it would if you gave the time and used it strong enough. As a matter of fact, one of the recent Navy specifications for removing scale from steel was to substitute phosphoric acid because they wanted to get away from the ill effects of the sulphuric acid.

Chairman Lewis: And jump right into the ill effects of phosphoric acid.

Mr. Smith: They may have some advantage from the standpoint of painting.

Chairman Lewis: Acid is acid and when mineral acid works on metal, hydrogen results.

Mr. Smith: I think they were after improved paint adhesion, which is another problem.

Chairman Lewis: There you are getting this phosphate coat you speak of, this tough adherent.

Mr. Smith: But you don't develop in the same way. Can you say anything to help?

Member: Well, the presence of ferrous phosphate on any metal is a lot different than the presence of ferrous sulphate. Ferrous phosphate is not a corrosive salt. It won't produce corrosion the way ferric sulphate would. That is why the Navy used the phosphoric acid. In the removal of mill scale, as it is done under the wire drawing practice, the phosphoric acid doesn't have the activity that the sulphuric acid does on a cost basis.

Mr. Smith: Ken says if the cost is even.

Chairman Lewis: There is not any terrific difference between them. If we had not started working with sulphuric acid and produced it in large quantities, it might have had a hard time crowding phosphoric acid out. I just tossed that in to illustrate what I said in my opening remarks, that there is nothing sacred in a wire mill. There is no product, no process, no technique there that isn't just hanging on until something better comes along, with the sole exception of the die. You can't draw wire without a die. At least, I haven't found a way yet. Anything else I have seen in the wire mill is merely hanging there until we find a way to eliminate or substitute.

Mr. Smigel: I have been around to quite a few of the Navy offices. They are building a lot of new pickling departments now. Every Navy yard pickling department has a sulphuric acid bath, a water bath, and a phosphoric bath.

Chairman Lewis: One of the old warhorses of the Wire Association is here. He has been in contact with this problem. Not being so close to mill operations these days, I don't know whether he has actually got a horse running in this race or not, but I am always glad to hear from Mr. Spruance, of American Chemical.

Mr. F. P. Spruance (American Chemical Paint Co., Ambler, Pa.): I was very much interested in the chairman's resume of the history of the wire industry. I have lived through a good many years in the wire industry. You know me and my company, particularly from our inhibitors. But before we had inhibitors, we were very much interested in the use of phosphoric acid as a preparation of metals for painting primarily. Our whole thinking has been directed along the line of phosphoric acid, so I think perhaps I can add something to this question of the use of phosphoric acid in pickling and perhaps as a means of preparing a surface for drawing.

I want to say before I get into the subject, though, that I agree with the chairman that this is a subject of vital importance to the wire industry. There is very decided interest in eliminating lime, and I think it might pay if someone in the audience here could very briefly say why lime should be eliminated.

In other words, if we know what we are trying to overcome, what are the disadvantages we are now facing, we who are not wire mill people but are interested in your success, might better approach the subject and might better present materials for your investigation.

Lime has been used a long while. Lime has done an excellent job. What is wrong with it? I hold no brief for it. The only briefs I hold are for facts and truth. But what is lime and why do we want to get rid of it?

Is there anybody who would hazard an answer? Ben McCarthy knows something about lime.

Well, there are disadvantages with lime, that is true, but it is cheap; it has done a good job; and it has been tolerably successful in counteracting the active rust which develops in the pickling operation. It provides a good bond for lubricants. It is not water soluble, and its presence on the wire probably interferes with subsequent operations. There may be a number of other disadvantages, but those probably are among them.

Now, as to more or less the history of this preparation of wire for drawing, I have seen a lot of it. A good many years ago, we had an idea that the development of a phosphate coating on wire might be very beneficial. We had some tests made.

We developed in one case a coarse crystalline coating, developed out of a solution of manganese phosphate. Iron phosphate would do the same sort of a job, but less rapidly. We had drawn some wire with a coating which we called our cuprodine coating. It was a very much thinner zinc phosphate coating. Neither of those, for some reason or other, seemed to produce the right sort of results.

We are supplying now, and are prepared to supply, a phosphatic material, which our Oakite friend here has discussed, which develops an even thinner phosphate coating. They have very distinct advantages. I think that at some time there will be further work done with them, and their relative merits will be developed.

There have been many other materials used as coating products. I can remember one of ours, which was an unusually interesting looking one. We never had any success with it in the wire industry, although we tried to interest them in it. It was merely immersing the pickled and rinsed rod in a sodium silicate solution.

We had a patent, which has long since expired, on that process. In it we used an alkaline material which had the effect of counteracting residual acid on the surface. It developed a very thin glass-like coating of silicate, which was friable. It pulled through the dies and cracked off on tubing. It did a very nice job, produced a nice, bright tubing, but we were never able to interest the wire producers beyond an experimental point, which was not at all conclusive.

You are all familiar, or many of you are familiar, with a distinctly different type of preparation for drawing. A good many of you are using the process in which copper is plated by simple immersion on the surface which facilitates drawing. It has its disadvantages, but it has many advantages. Where a copper coated wire is needed, of course, copper is used.

But I have had in the back of my mind for many years the fact that a part of this improvement in drawing comes from the ability to remove, what I would like to call, a fuzz on the surface. No matter how finely finished that surface may be, I know that it still contains little particles which under extreme pressure become heated to the point that they will weld to a die or journal bearing or to something else, and that that welding is responsible for undue wear.

We have played with that. If you can visualize a surface on which you have fuzz particles, and these may be magnified, those fuzz particles are much more reactive to the acid than a flat surface. The very nature of them means that they go first, so that those fuzz particles are knocked off the top, and you gradually approach a surface which will have an equal heating effect.

That is theoretical, but I believe that that is responsible for it. So that in these coating processes, provided that they are on the acid side, you will remove those particles which I feel are responsible for this welding condition and for the excessive wear on dies because you can pull them out, weld the wire to the die or the die to the wire. I think that that, too, is a factor. With copper dipping you have removed that fuzz and at the same time

you have plated on to the surface a thin coating of copper with whatever drawing facilities that may present.

The question of pickling in phosphoric acid has come up. Probably a good many of you do not realize that that has been used. It is definitely slower than either sulphuric or muriatic acid in its ability to remove mill scale. That in itself, I think, would in many cases exclude it, though the more important factor is its higher cost.

It is the subject of a British patent, to pickle in phosphoric acid, and to use that phosphoric acid solution after it has accumulated a certain amount of iron as a rinse bath into which the pickled surfaces are immersed, and then they acquire a phosphate coating. Primarily in that case, I think, in the subject of that patent, it is to provide better paintability. But if there is any merit in a phosphate coating, it can be produced by that means, although I think there are better ways of approaching that subject.

We, too, are interested in the development, particularly, of a thin phosphate coating, which in addition to having a cushioning effect will tend to hold lubricants, probably as well as lime, and will also have a rust-retarding effect; I would think quite comparable to alkalies of a relatively low pH.

One thing that I cannot refrain from discussing at this time is the difficulty which we and some of our men here confront in doing a research job which will be helpful to your industry and to ours. It is impossible in the laboratory to develop a chemical and then determine whether it has any merit at all. The only proof is to put it in a mill, pull it through a die in sufficient volume to find out what its effect is on the die life.

That is one of the things, I think, which has slowed up considerably the development of these coating materials and processes. There are little apparatuses which can be used to tell you something. There is, for example, the LaVelle tester, in which a small spindle is rotated between two blocks. Its purpose is primarily to determine the effect of lubricants. With those you can get results which are extremely encouraging; and with those same materials in production, you get results which are extremely discouraging. So that I know of no way for a research laboratory to develop products without the closest cooperation of the mill.

If it is a question that is of vital interest to the mill, it is going to be a matter of the mill collaborating very closely with those of us who are interested in research on the mills' behalf. We are going to make some money out of it, I hope, but it is for your benefit as well as for ours.

I think these things sort of develop in steps. We go along. We have worked for a half century or a century on lime. Now, apparently, lime is taboo; but there will be another stage, and we will go along again. But we do have to have close collaboration between the mills and us.

One other comment on Mr. Trembicki's paper. This is not heckling at all, Mr. Trembicki, because my idea is to see if something good can't come out of this.

You fellows are all interested in drawing wire in production. You all have chemists, but your job and your business is to produce wire. Our job and our business is to produce things that will help you produce wire. So I am only interested in cooperation between these two industries.

There was one point that Mr. Trembicki mentioned in his paper, and Mr. Smith has also called attention to it, and that is this question of acid embrittlement due to the use of material, alkaline material of relatively low pH.

I don't quite understand how a material of that sort can prevent or overcome the effect of embrittlement caused in pickling. I am wondering, Mr. Trembicki, whether it is the action which occurs or whether it is that the material has so much better lubrication that you don't see the effect of the embrittlement?

Mr. Trembicki: It is the heat of the solution that does it.

Mr. Spruance: Well, you will use a boiling lime solution. You could use a boiling caustic soda solution or trisodium phosphate solution. They won't do it. It is not the heat for so many minutes in itself, as I see it.

Mr. Trembicki: Well, I can't explain it in detail, but I do know as a fact, and I believe some of the representatives of the mills from their experience know, that tons and tons of rope wire have been coated that way, and that wire has not been baked, and there has been no embrittlement in it at all.

Mr. Spruance: It may be right. The chairman is interested in flash bakers. I know there are a number of mills who, with some of our newer coatings, have almost eliminated any baking other than that of drying the coating in these flash bakers. I think a great step has been made in reducing the amount of absorbed hydrogen in these metals, with the consequent reduction in the embrittlement.

The thing I am afraid of in the use of anything which will not actually remove the hydrogen and mask its presence by, probably, better drawing, is that the hydrogen is still there. In the formation, for example, of springs, the wire will still be brittle. So if you cover it over and don't remove it, you have only lost the appearance rather than the fact that the embrittlement has been eliminated.

Chairman Lewis: Thank you very much, Mr. Spruance. You have relieved my mind to this extent: I see that all I have to do is change the name of the flash baker to flash dryer, and go rolling right along. [Laughter]

You surprise me considerably by your kindly attitude towards lime. I thought that I would have to have a lime man here to defend the product. I thought of Ham, of course, but Ham is a shy, shrinking, modest fellow who hates to say a word, and I just hated to bother him. In fact, as you have done so well by him and several of the others have thrown in kindly words, I don't think we need bother Ham to any great extent. But I suggest that before he is laid on the marble slab that he stand up and, for old time's sake, just take a bow and give a last look at these friendly faces. Will you do that? [Applause]

Member: Thank you, Ken. May I be permitted to get in one little suggestion? When I came to this convention Monday, the grapevine was working, and it was hinted that the boys were ganging up on me, going to throw lime out of the industry.

If I am to be elected as the star in the funeral, I am reminded of an incident that took place some time ago in prohibition days, when a gangster was shot, and they had him in his nice, comfortable coffin. I always felt sorry for corpses in a coffin; they look so lonesome there. That is the point of my story. A cute little boy with a tommy-gun came to the funeral and mowed down all the pall-bearers and dumped the whole bunch into the coffin with him.

To point the story, I think a lad will come along who, instead of a Tommy-gun, will invent a rod that doesn't need cleaning at all. Then we will all go out of the picture. [Laughter]

Chairman Lewis: Is there an acid man in the house? [Laughter]

Member: I have gleaned some satisfaction from the remarks that have been passed of the continued tolerance, at least, of lime, to the point of dye boxes. But I don't think the old girl was ever designed in the beginning to perform as she is now expected to perform. Originally it was a tub proposition, the Saturday night bath. Now she is asked to do tricks, such as to pull down a six hole draw.

Harold, sixteen years from now, will your compound draw down through a 16 block draw? Will there be such an animal? Who knows?

I think lime has done a pretty good job up to now, and I just want to make this remark, helping out my friend Ken in his prediction some time ago about the length of time that lime would continue to be used. I personally can guarantee that it will be used as long as I live, and after that, I don't have to worry. [Applause]

Chairman Lewis: Our experts have spoken so well and at such length that I don't know whether the general public will have anything to add or not. I want to apologize for having messed up the time element here a little. We couldn't get started on time. I have just been informed by Mr. Brown that we have to be out of here in about 25 minutes.

Let me ask if the membership in general has any comments to make or questions to ask on this general subject at this time.

Member: I would like to ask Mr. Trembicki if he would enumerate or draw a dividing line as to where you would use lime or other coating compounds? Obviously at the present stage of development of his compound, you still have to use lime in a certain range, and later on the use of compounds has certain advantages.

Chairman Lewis: I am not sure that he would agree that there is a line to be drawn. If I am any judge, if my past experience is of any value in a matter of this sort, it will be very hard to get any of these boys to admit that their product will not ultimately sweep the field. But Mr. Trembicki can answer for himself.

Mr. Trembicki: That is a hard question to answer. Of course, considerable lime is still going to be used because we are just feeling our way now. It is true that we have made a lot of progress. As I mentioned there are some whole wire mills that are running without lime. The fact that they are running would indicate that some time in the future we will be able to run others in the same way.

I would say that for almost any type of wire, with the exception of wire for heading and extruding, can be drawn without lime and with just the coating on it. As I said before, it is of particular value on any surface that is going to have any finish—painting, plating, welding wire, and particularly on bright wire.

Regarding the cold-heading wire, I still think we are going to do that because we have done it. The manufacturer who

(Please turn to page 102)

Meeting, Wednesday, October 17 — 3:00 P.M.

Chairman of Meeting

Sidney Rolle
Asst. Mgr. Scomet Engineering Co.,
New York, N. Y.

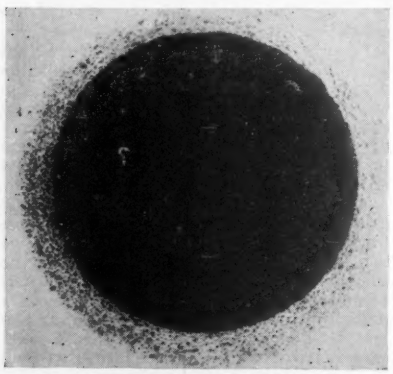
Working Habits of Beryllium Copper Wire
by Matthew J. Donachie, Metallurgist,
Beryllium Corporation of Penna.,
Reading, Pa.
Published October, 1945 — Page 719

Written Discussion
Presented By
H. S. Freynik,
Chief Metallurgist,
Riverside Metal Co.,
Riverside, N. J.

LARGE quantities of Beryllium Copper wire are drawn to small diameters by redrawers who do not make or start with a cast ingot. This paper should prove of greatest interest to this particular group of wire men.

✦ ✦ ✦

WE are interested in the author's reference to skin conditions on Beryllium Copper wire produced by annealing, with particular reference to Fig. 1. Without reference to past history, we would have tentatively concluded that this wire had been annealed in a molten salt bath. The following illustration shows the effect of a one-hour immersion at 1450° F. of wire in a molten salt bath consisting of 50%-50% potassium chloride-sodium carbonate:



Cross Section 30×
Light Etch HH4OH —H_2 O_2

You will note the intergranular corrosion, which is similar to the author's Fig. 1. This surface condition is extremely difficult to remove by acid pickling and requires strong solutions. The end product always looks like the author's Fig. 5. The depth of the penetration is directly related to the time in the salt bath. We have never tested a salt bath composition which would anneal Beryllium Copper wire without intergranular corrosion.

✦ ✦ ✦

HOWEVER, the author indicates that his wire was bulk annealed in an atmosphere. We cannot understand how such a surface condition can be produced unless the oxidation products of many previous anneals had not been removed during the drawing operations. Fig. 1 indicates that about 25% of the cross section of the wire was destroyed.

✦ ✦ ✦

IN our plant, we have annealed wire in furnaces fired by gas, oil and electricity and have never seen a surface comparable to the illustration. Just before submitting these comments, we annealed a coil of wire in an electrically fired recirculating furnace, with no artificial atmosphere, for 3 hours and could find only a thin oxide coating on the wire, which was readily removed in an acid pickling solution.

✦ ✦ ✦

WITH the author's recommended pickling solutions we can expect considerable trouble. The hot oxidizing solution in the proportions mentioned has a faster dissolving rate on the metallic Beryllium Copper than on its oxides. Consequently, since the oxidation on the surface is non-uniform, the solution will cause severe surface pits in sections first exposed by oxide solution.

THE practice of a considerable part of the industry for many years has been to pickle first in a solution consisting of 1-1 sulphuric acid-water at a temperature of approximately 170° F. This solution dissolves the bulk of the surface oxidation, but has little effect upon the alloy itself. The wire is next finish cleaned by a short immersion in a solution of the following composition: Sulphuric acid 1 part by volume; water 9 parts; approximately 5 ounces of sodium dichromate to a gallon of solution. This second solution is used **at room temperature.**

✦ ✦ ✦

IN Fig. 4 the author illustrates a situation showing gamma phase precipitation at the grain boundaries due to poor solution anneal, and which will cause trouble in wire drawing. It would be interesting to know the actual beryllium content of this sample. Did the author definitely identify the constituent as gamma and not as beta? A longitudinal view through the wire would identify this phase as beta if it were in the form of stringers. Perhaps the author could cast more light on this question. If this phase is definitely gamma and would cause difficulty in drawing, why is the gamma phase so desirable for drawing when formed by the "homogenizing" treatment later described?

✦ ✦ ✦

IN our experience, we have found that the surface condition of the Beryllium Copper wire has the greatest influence upon drawing. Next in importance is the beryllium content of the alloy. Over approximately

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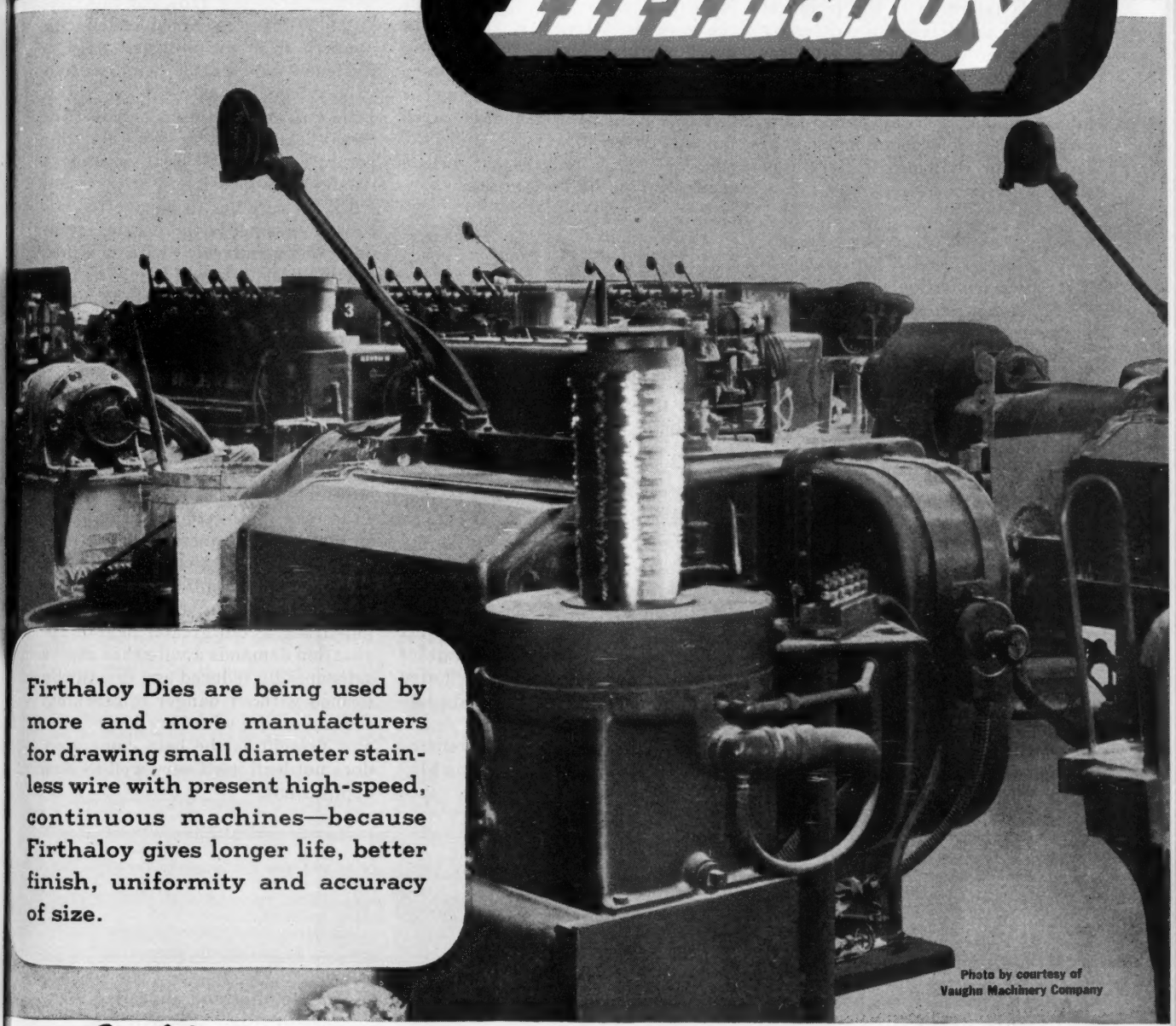

Firthaloy Dies are being used by more and more manufacturers for drawing small diameter stainless wire with present high-speed, continuous machines—because Firthaloy gives longer life, better finish, uniformity and accuracy of size.

Photo by courtesy of Vaughn Machinery Company

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2.05% in beryllium, large quantities of excess beryllium are usually segregated in the form of stringers. This phase is extremely hard, and harsh on drawing dies. In addition, the structure of this wire promotes rapid work hardening and brittleness in the drawn condition.

IN closing, we would like to congratulate the author upon presenting an interesting paper.

Written Discussion Presented by
S. A. Avallone, Metallurgist,
Spencer Wire Co., West Brookfield, Mass.

WITH reference to the technical paper on Beryllium, written by Mr. Matthew J. Donachie, after reviewing this paper I wish to compliment the author on an excellent job of explaining away some of the causes of trouble so often encountered in the drawing of Beryllium Copper Wire.

✦ ✦ ✦

THE skin condition described has been in our experience one of the greatest problems confronting the wire drawer. Die cost is prohibitive in fabricating wire with surface layers of this oxide skin and production running cannot be maintained. The method for removal of this skin or preventing it from happening is welcomed.

✦ ✦ ✦

WE note that in temper straightened wire the author states that tensiles of 220,000 PSI are readily obtained. This is true, but since this is one of our largest product uses in Beryllium Copper we have found that it cannot always be readily used at the high tensile value, due generally to local or spot brittleness. In wire for shaping or coiling over a large radius, say about four times the wire diameter, it is fine but in sharp angular forms, or crimping applications we find it preferable to temper back, depending somewhat on size and end use to tensile strength limits between 165,000 PSI and 195,000 PSI. This reduces the brittle tendencies in the local areas.

✦ ✦ ✦

IN considering this local brittleness, it brings up a couple of questions upon which we would like to have the writer's opinion. In some shipments from the primary supplier a few bundles or coils are sometimes found that draw well enough but the wire cannot be bent sharply or crimped. Other times, what is perhaps worse is that the brittleness in bending or crimping may be spotty or highly localized and makes continuous processing very difficult. Our laboratory has found almost invariably either axialy segregated clusters of beta or an excessive amount of beta phase compound distributed across the section as extended globules. In these cases wire cold drawn as little as two numbers or tempered wire softened back to as low as 145,000 PSI cannot be bent or crimped without breaking. How can this condition be overcome? In annealed wire received from the mill, not only is the tensile range rather wide, we find values from 64,000 PSI to 91,000 PSI, but for wire used in short interval heat treatment at higher temperature from 800-1000 consistent results are impossible. For precision work, all wire has to be selected before processing. Is there some method of testing annealed wire on a production basis that will assure us that the entire bundle is properly annealed and quenched?

✦ ✦ ✦

WE are of the opinion that from the re-drawers' viewpoint this paper is a most useful contribution, but think the work should be expanded to take into account not only the aforementioned questions, but also such things as drawing speed—dies—lubricants—and range of alloy composition. This latter we consider important, as our greater field of application demands a wire that can be substantially reduced and drastically formed without danger of cracking. Certainly wire with beryllium in excess present as the beta compound, does not lend itself very well to such applications.

Written Discussion Presented by
J. Ogden, Works Manager,
Little Falls Alloys Company,
Paterson, N. J.

MR. DONACHIE has brought out clearly and lucidly the story of the working of Beryllium Copper Wire.

✦ ✦ ✦

WE concur with his findings, that maximum physical properties of age hardened wire can be consistently obtained only by close control of solution annealing temperature and rate of quench. It is our experience that batch annealing and quenching of wire does not permit uniform rates of quench, and variables in age hardened fabricated parts result.

THE use of strand annealing using constant speed, eliminates the possibility of variations in temperature and quench rates, thus assuring a uniform product.

(Please turn to page 95)

that we ought to get real pearls of wisdom on beryllium.

Mr. Donachie, the floor is yours. [Applause]

. . . Mr. Matthew J. Donachie (Beryllium Corporation of Penna., Reading, Pa.) read his paper entitled "Working Habits of Beryllium Copper Wire." . . .

Chairman Rolle: I am quite sure that you agree with me that Mr. Donachie has done a very fine job. We have quite a number of written discussions here.

. . . Chairman Rolle read the discussion of the above paper by Mr. H. S. Freynik (The Riverside Metal Company) . . .

Chairman Rolle: That is the sort of comment, I think, that we all appreciate. The author appreciates that the work is very well done, but has disagreed in part. I am sure that Mr. Donachie will be able to answer these various questions that have been raised. It might be well to do that before we take up the next discussion.

Mr. Donachie: I am very happy to have Mr. Freynik's discussion, and it is certain that we agree on two important points. One is that the skin conditions of beryllium copper wire is very important and that our salt bath experiences are similar.

In regard to Fig. 1, this skin was found on a wire from a field problem where the annealing was carried out in a gas fired muffle furnace without the use of a protective atmosphere. As stated in the paper it is excessive but exemplifies the undesirable state of affairs which may be produced on the alloy surface by improper annealing procedure.

On the question of pickling, we have in the past followed the general practice outlined by Mr. Freynik; and for fine finish dipping use the cold dichromate subsequent to the hot dip and rinse this does a nice job. However, we have found in the field that the character of the scale formed on beryllium copper wire may vary widely, depending upon the atmosphere in the furnace, the effect of carried over lubricant on the wire and other variables. In some instances the oxide skin developed is very refractory and difficult to remove by the sulphuric acid dichromate combination. So it has been upon our findings over many years and under various field conditions that the bath as prescribed offers the optimum pickling for preparing wire for redrawing. The surface etch effect produced facilitates the pick-up of lubricant and enables the wire to carry it into the die. As to pitting, we have not yet encountered any pits in extended tests that are attributable to the bath itself. It does, however, readily show pits caused by imbedded scale or oxides which when removed leave cavities.

In considering the group of questions posed around the structure in Fig. 4, I shall take these in order. The figure was photographed from a bundle of wire which was giving trouble in drawing and inconsistent response in hardening. The composition by analysis: Beryllium 1.97%, Cobalt 0.18%, Al. 0.05%, Si. 0.08%, Fe. 0.10%, Copper 97.57%. The constituent is gamma phase partially ejected and progressing in from the grain edge into the body of the grains. The section is longitudinal, unfortunately in preparing the paper, all sections were not marked. However, all photo micrographs shown are from longitudinal sections. We agree with Mr. Freynik, beta inherited from the ingot will invariably show its presence in the form of longitudinal stringers. The question of identification is appreciated as in acid etching the beta constituent will darken and not all dark etching formations in either alkaline or acid reagents on grain boundaries are due to uncontrolled decomposition of the alpha phase. In this instance, reannealing and quenching eliminated the boundary product. Prior to reannealing, the wire had a specific resistance of 58 ohms per c.m.f. and after reannealing and quenching 61 ohms per c.m.f. The final check was made by microscopic examination which showed that the boundary pockets were eliminated. The next figure presents white beta stringers and also the boundary product discussed. As already mentioned not all dark etching material on the grain boundaries are gamma precipitate and some question is bound to arise as to their identity. We have examined such things and in this instance are sure of the product. In the slide on the screen which is from a specimen partially precipitated or harden for ½ hour at 450° F. to help preparation in polishing is an unetched structure. Note the black patch in the center where the 3 line come together. This is the junction of 3 grains surrounded by a film and the dark pit is due to a loss of some of this material in polishing. This image is at 1500 diameters and is markedly different from the gamma phase. In this instance it is continuous as a membrane though it does not always come that way.

In the next slide a longitudinal section showing discontinuous oxide patches entrapped and drawn down is shown. You will notice here that by their presence the metal has layer characteristics and that the grain growth in the neighborhood has been restricted by their presence. Dependent upon their size and distribution and section under examination this entrapped dirt offers a little problem in identification as compared to the gamma phase. This metal condition is due to poor casting shop practice. The oxide being generated either in the furnace or in pouring.

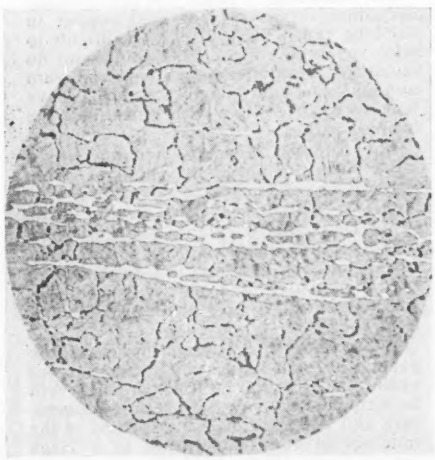

Fig. 1—250 x beta stringers and boundary gamma etch ammonium persulphate. ✦ ✦ ✦

Mr. Freynik's next point is well taken. Why is the gamma phase in one case undesirable and cause difficulty in drawing and why in the other case is it desirable as produced in the homogenizing process.

In the homogenized product precipitation has been deliberately induced and the precipitate grown to a spheroidal product as shown in the slide. This treatment produces a thorough and uniform distribution of the precipitated compound (a near analogy is spheroidized high carbon wire) the matrix is also recrystalized and there is no danger of subsequent precipitation due to either heat or strain or both in further working. In the structure of Fig. 4 the gamma as ejected is fine and has but little growth. These islands of uncontrolled alpha decomposition are non-uniform in distribution and set up highly localized strain areas in drawing and in their immediate vicinity are harder than the general matrix.In short, it is not the presence of the gamma alone but its distribution which produces the effects.

In each of the cases here we are trying to exemplify with reality. These are not things we have made, these are some faults we have found. The same is true of the skin condition. I have tried to emphasize the fact that even incipient layers of corrosion will produce trouble in drawing and the utmost precaution must be used to guard against them.

Mr. Freynik's comments in drawing attention to the upper limit of beryllium composition is appreciated; except in special cases for general wire work Beryllium over 2% is undesirable and for reasons as pointed out by Mr. Freynik.

. . . Chairman Rolle read the discussion by Mr. S. C. Avallone (Spencer Wire Company, West Brookfield plant) . . .

Chairman Rolle: There is a nice challenge, Mr. Donachie, and some very interesting questions.

Mr. Donachie: Mr. Avallone's comments are really something to consider. I can see his picture from a redrawer's viewpoint. Spot brittleness of the type that he is referring to is usually traceable to poor ingot practice.

The beta phase is either segregated or the beryllium content runs too high and the excess amount comes out, but fairly well distributed over the section. In the latter case it eventually clusters up in drawing far enough. There is no doubt but that such material will not draw very well. That is a matter of setting up a compositional range, which is more or less still arbitrary in so far as any wire standard is concerned. We prefer for wire working to try to avoid it by keeping the composition below two per cent beryllium.

On the other hand, even at two per cent beryllium, there exists a tendency to produce segregated axial beta. Great care must be exercised in the foundry practice in the manufacture of wire bars or such things will be constantly occurring. That in general accounts for this spot brittleness which shows even in tempered wire as low as 145,000 PSI for tensile.

As to wire which varies in tensile from 64,000 to 91,000, that is really a matter of poor quenching and is related to this gamma phase which I have shown. Using 1.9

Fig. 2—1500 x boundary membranes of oxide. Unetched. ✦ ✦ ✦ ✦ ✦

to 2 per cent beryllium, the tensile should not go up over 70,000. If you run it up as high as 91,000, you have a decided amount of precipitation. An electrical resistivity check will show that. This is a good spot method for determining the freedom from precipitation after the quench.

On the matter of speed, lubricants, and dies, I think that would be worthy of another paper. As to lubrication for dry drawing, we use dry soap with 92%—42 titre-tallow base soap powder the greatest success. In wet drawing we use an extreme pressure lubricant of sulphur-chlorinated oil, which has been the most useful thing we have found so far. We do mostly heavy wire and but little wet drawing tungsten carbide dies as used with the above lubricants, and the die life is exceptionally good. However, wire drawing is still an art as much as a science. I have known boys who, with two rain barrels, could probably draw better wire than we could with the best machines ever made. That is neither here nor there.

I don't think I can at this time offer much more on Mr. Avallone's comments. I think they are a little too wide for the scope of the paper.

Chairman Rolle: That takes care of that. Does anybody want to tackle this? I think the audience is very modest, or maybe I have another word for it.

We have one more written discussion, which I thought was rather good, from Mr. Ogden.

. . . Chairman Rolle read the discussion by Mr. J. Ogden (Little Falls Alloys, Inc., Paterson, New Jersey) . . .

Chairman Rolle: I don't suppose there is much to be said about that. We would like to hear from the audience. I was very pleased this morning that despite the fact our Mordica lecturer was on pins and needles, the discussion kept right on. I think we non-ferrous fellows ought to be able to equal that.

Mr. Manley Ross (DuPont): Speaking of the oxide film, we have deoxidized copper and one company is now working on that with the idea of putting in copper drawing equipment in which the scale has been reduced by sodium hydrate baths and the copper is not attacked. You quench off most of the oxide and go right ahead with the drawing operation.

Here is a case where I think you could reduce your beryllium copper oxide and you would not go after either of the metal constituents. I would like to try it sometime.

Chairman Rolle: Perhaps Mr. Donachie has already given it consideration.

Mr. Donachie: No, we haven't. In fact, it is the first time we have heard of it. It sounds very interesting. We know in our other work with beryllium that sodium will displace it. But as far as sodium hydrate and its reaction on the skin film is concerned, as I said yesterday in another discussion, if you want to count the teeth in the horse's mouth, the best thing to do is to catch it. You send me some sodium hydrate, and I will see if it works. It is interesting, and certainly worth trying.

Mr. Ross: We have to make it in position, you see.

Mr. Donachie: Oh, in situ.

Mr. Ross: So I suggest you send us the wire. [Laughter]

Mr. Donachie: All right; we will send you some wire.

Chairman Rolle: That is one way of getting a nice expensive product for nothing.

Mr. Ross: I will send the wire back.

Mr. Patterson (Bausch & Lomb): I had one question regarding the use of the salt baths in this beryllium copper wire. At what temperature do you find that that pitting starts to occur? Also, do you find any detrimental use of salt baths in the precipitation treatment, ranging from 575 to 700 or so?

Mr. Donachie: We have never been an end user of beryllium copper. It is our opinion that there is no salt bath that can do it any good.

Mr. Patterson: Even at the low temperature?

Mr. Donachie: At the lower temperature, the reaction proceeds at such a slow rate that in the range where it is normally used, between 375 and, say, 900, the little incipient attack probably doesn't do it any material damage. But in the higher temperature range, above 1,200, the attack is very fast. Salt baths are used for heat treating, incidentally, of beryllium copper product parts, where temperatures are low and time is short.

Mr. Patterson: That is right. We have used it at the lower temperatures, and I haven't noticed any ill effects.

Mr. Donachie: You will notice you get skin oxide on it, though, in very short order.

Mr. Patterson: Yes, we still get a film on it. One other thing, is the pitting limited only to beryllium copper alloys or is it present in other copper alloys?

Mr. Donachie: I think you can consider beryllium copper 98 per cent copper in the long run. I think it is very difficult to take any high copper base alloys and do much salt heat treating with them. I am not an expert on that score, but I have had very little luck with them, on the bronzes either.

Mr. Andrew Meyer: I would like to know how the beryllium oxide is introduced in the alloy. Is it in the casting process? At what temperature does it form?

Mr. Donachie: Beryllium oxide, as such, that is, pure beryllium oxide, is only formed during melting. Its heat formation is very high, and once it is produced, we don't know any way of simply reducing it in the melt.

The oxide we are referring to in the paper, the skin oxides are formed at annealing temperatures. Indeed, they will be formed at any process heating temperature and the type of oxide formed is the function of the temperature to a large extent, from 475 to 1,500 °F.

I don't know how to express this, but we

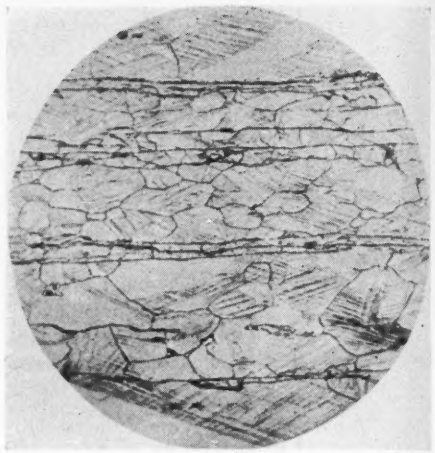

Fig. 3—300 x stringers of oxide patches etched ammonium hydroxide and hydrogen peroxide. ✦

know where it is not excessively oxidizing, you will come out with a yellow skin on the alloy rather than a dark one. That is due to proffered oxidation of the beryllium itself directly on the surface of the metal.

Mr. Farraday (Illinois Tool Works): Unfortunately I have not had the opportunity of reading the article prior to my coming here, but I heard the author mention the chemical composition of the alloy as copper, beryllium, and cobalt.

I understand that some authorities recommend the substitution of nickel for cobalt, and the claim is that some of the gamma brittle constituents are more or less eliminated. I wonder if the author would enlarge or qualify some of those statements and give his opinion on it.

Chairman Rolle: Is there anybody from American Brass Company here, Anaconda? They could answer that very well, but I think Mr. Donachie can pinch-hit for them.

Mr. Donachie: In any commercial alloy which is sold as beryllium copper containing approximately two per cent beryllium, it seems as though the addition of any of the heavy metals, iron, nickel, or cobalt, have an effect in that they slow up the precipitation reaction rate. That is the gamma phase you are referring to. It takes longer to heat-treat it; the reaction rate is slowed up by the presence of any of them.

There have been claims made over a period of time that cobalt does certain things as a grain refiner that nickel and iron and silicate don't do. I don't doubt but that they all have a similar type influence. The major one is that they seem to retard the precipitation rate on heat-treating. They prevent rapid over-aging, which is very useful in some cases.

As to any other specific effects they may have, there seems to be the general effect in active grain refiners on the initial casting, and they act as inhibitors on subsequent heat treatment as compared with straight binay alloys.

Chairman Rolle: I was particularly interested in what Mr. Donachie said about the casting, having had a little experience in that field. We have found invariably that the end product can never be any better than the original casting. Of course, you can spoil a good casting, but you cannot make a good fabricated product out

(Please turn to page 96)

Meeting, Thursday, October 18 — 9:30 A.M.

Chairman of Meeting

K. H. Davis, President,
K. H. Davis Wire & Cable Corp.,
Los Angeles, Cal.

Insulating Wires with Vinyl Resins,
by Dr. Carl L. Shapiro, President,
General Materials Research Laboratories,
Beaver Falls, Pa.
Published
October, 1945 — Page 724

Measuring Wire Stiffness by Low Stress Elongation
by C. B. Shopmyer, et al,
General Electric Company,
Schenectady, N. Y.
Published
October, 1945 — Page 752

PAPER: Measuring Wire Stiffness by Low Stress Elongation

Written Discussion Presented By
C. J. Snyder, Engineer in charge
of Metallurgical Laboratory,
Anaconda Wire and Cable Corp.,
Hastings-on-Hudson, N. Y.

A SENSITIVE but reliable test method for determining the softness of copper magnet wire is desirable to both the supplier and the consumer of such wire.

✦ ✦ ✦

MANY devices or instruments have been built, most of them being home-made simple devices, and some have been very useful. In 1929 the writer, then a consumer, obtained an agreement with a supplier to inspect magnet wire to a resiliency test, using his specially designed bending device. Since then more and better test devices have been designed and are being used in the trade. Most of them have proved satisfactory for their intended purpose but none has been adopted for all around usage.

✦ ✦ ✦

THE LSE test, as described by Mr. Seymour, appears technically sound. The testing devices proposed for the LSE test appear to be especially well designed for simplicity of use, although perhaps not simply constructed. The simplicity of expressing the results of an LSE test is highly desirable. It is probable, however, that different standard values or ranges of acceptable values for different size ranges of wire and/or different insulations would be needed, even for the LSE test. Data have not been presented to show that a universal test value can be used in specifications for all types and sizes of wire.

✦ ✦ ✦

IN Mr. Shopmyer's paper, the mean- of the words "tensile strength" on page 3, paragraph 2, and again on page 4, paragraph 3, was not entirely clear to us. Does he mean "tensile properties" or "deformation under tension"?

It would be desirable to standardize on a method of test for the industry. It appears to the writer that there are a number of test methods which would satisfactorily show the softness of magnet wire, one of which is the LSE test proposed by Mr. Shopmyer.

Written Discussion Presented By
B. J. Sirlios, Metallurgist,
Phelps-Dodge Copper Products Corp.,
American Copper Products Div.,
Elizabeth, N. J.

WE have read with considerable interest the report by C. B. Shopmyer, "Measuring Wire Stiffness by Low Stress Elongation," and wish to offer the following comments:

✦ ✦ ✦

THE prime purpose of this method of testing, as given in the opening paragraph of the report, is the determination of the windability of **magnet** wire. However, as we understand the report, it describes the test apparatus and method of testing soft **bare** copper wire to determine the suitability of the wire for winding purposes.

✦ ✦ ✦

IF it is the intent of the author to require that magnet wire be stripped of its insulation before testing, it is our belief that many factors entirely foreign to the quality of the copper will make the test result accurate or of questionable value. Some of these factors are:

1) **Questionable assumption that the elastic limit of annealed copper is 7500 psi. Careful tests show that it is somewhere between 4000 and 5000 psi.**
2) **Improper handling of the test specimen during sampling, straightening or stripping of the insulation may cause hardening of the specimen and result in a lower permanent elongation on removal of the 15,000 lb. load, even though the stock from which the specimen was taken may**

be satisfactory for winding.

3) Error in measuring cross sectional area by weighing may be considerable if precautions are not taken to remove carefully all insulating material from the specimen to be weighed and may lead to considerable error in application of proper load. If micrometer measurements are used, the errors in calculating cross sectional area, particularly of wires of small diameters, are also obvious.

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IT should be borne in mind that the result of this test performed on a sample stripped of its insulation still cannot be considered an accurate measure of the windability of the insulated wire, since the insulation itself does affect the winding characteristics of the insulated magnet wire.

✦ ✦ ✦

THERE is, therefore, considerable doubt in our mind as to the desirability of this method of test being used as a basis of a general specification on the qualifications of magnet wire for winding purposes.

Written Discussion Presented
By E. P. Hall

I THINK we owe a vote of thanks to Mr. Shopmyer for presenting a paper which should be of real interest to the Magnet Wire Industry. Proper testing of magnet wire for softness or windability is of great importance and it should be to the interest of all concerned to have the elongation test replaced, in standard specifications, by some more reliable method. Probably general opinion will agree that the elongation test is unsatisfactory, but unfortunately there appears to be no general agreement on which method or methods of test should replace it.

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IN considering testing methods, it might be well to divide magnet wires into two classes. **Class 1** to contain rectangular and square wire and round wires which would normally be drawn from a rod to final size in one drawing operation. **Class 2** might consist of round wires which require two or more drawing cycles to final size. It does not necessarily follow that one method of test would be generally satisfactory for each class of wire.

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ANY method to be satisfactory should have certain conditions: It should

1. Measure that property of the wire which is essential to coil winding
2. Be reproducible by different operators
3. Be easily and quickly made
4. Apparatus should be inexpensive

✦ ✦ ✦

I HAVE not had sufficient personal experience of the L.S.E. test to make positive statements, but data gathered from various sources would indicate that the L.S.E. test, within the capacity of the apparatus described, would meet conditions 1, 2 and 3, as previously mentioned and should receive serious consideration as a method of test for Class 2 wires. Its relatively high cost would probably restrict its use to the larger laboratories, which is a drawback.

✦ ✦ ✦

THEORETICALLY this test can be made on tensile strength machines, but practically it is difficult to do so on some types of equipment and the time necessary to make the test is too great for routine testing. It would seem that some form of the resistance to bending or the springback test, in combination with a maximum Rockwell or Scleroscope number, would be more satisfactory.

ORAL DISCUSSION:

The meeting convened at ten o'clock, Mr. K. H. Davis (K. H. Davis Wire & Cable Corporation, Los Angeles) presiding.

Chairman Davis: This is the Thursday morning technical session of The Wire Association, devoted to the non-ferrous group. We have some very interesting papers this morning which I am sure you will enjoy, especially if you get up where you can enter into the spirit of the thing.

We are going to start with the second paper on the program, "Measuring Wire Stiffness by Low Stress Elongation," by Mr. Shopmyer of General Electric. We would like everybody at the end of the resume given by the speaker to enter into a free discussion. Everything is off the record.

Mr. Shopmyer [Applause].

. . . Mr. C. B. Shopmyer (General Electric Company, Schenectady, New York) read his paper. . . .

Chairman Davis: We have written comments from several people who are very much interested in this method of determining the stiffness or windability.

. . . In the absence of the commentators, Chairman Davis read the discussions by Mr. B. J. Sirois (Phelps Dodge Copper Products Corp.); Mr. C. J. Snyder (Anaconda Wire & Cable Company), and Mr. E. P. Hall (Kennecott Wire & Cable Company).

Mr. Shopmyer: Mr. Hall's comment indicates a problem that is common in wire tests generally. For sufficiently accurate results in the case of rectangular wire, it is usually not too difficult to remove the insulation from short lengths of wire which may be weighted to determine the cross-sectional area.

With insulated wire, larger than .005 inches in diameter, removing insulation is generally not necessary. In cases where the removal of the insulation is such that it may affect the results, it usually is best to remove it with the aid of chemicals.

Chairman Davis: There is a comment in Mr. Sirois' discussion on the assumption that the elastic limit of annealed copper is 7500 psi. He states that careful tests show it is somewhere between 4000 and 5000 psi. You used the figure of 7500 in the tabulation of your tests for the determination of your first load factor.

Mr. Shopmyer: Wire that is sufficiently soft to take a permanent set in a reasonable length of time will undoubtedly have a hardness in excess of 150 Brinnel which is nearer 7500 psi.

Chairman Davis: Any other comments, gentlemen? This is a subject which has brought out a lot of discussion by mail, and we find that no one has come here to substantiate his statements. Am I mistaken in this?

Mr. Rolle: As I understand it, Mr. Shopmyer, your machine is really a tool used for measuring stiffness of wire drawing fabrication and is not one that is so commonly used on wire after it has been manufactured. Is that correct? In other words, you are using the machine to determine whether the copper has the proper characteristics for use in certain types of wire.

Mr. Shopmyer: It is used equally, I would say.

Mr. Rolle: After insulation?

(Please turn to page 98)

Written Discussion Presented By
Ralph Hall, Chief Engineer,
Inca Manufacturing Division,
Phelps-Dodge Copper Products Corp.

IN Dr. Shapiro's paper presenting Vinyl Resins used on wire, he should include in the typical vinyl compounds Vinyl Acetal, known as Formvar, since this has found wide use in the magnet wire industry as a thin film magnet wire insulation. The structural formula of the basic resin of Formvar is as follows:

Base	Additive	Complete
$CH_2=CH$	$HCHO$	$CH_2=CH\text{-}O$)
		$CH_2=CH\text{-}O$)
CH_2		

✦ ✦ ✦

HOWEVER, in the actual manufacture of this type of wire, the Formvar resin is reacted with a phenolic resin, which acts as a stabilizer to increase temperature resistance and to harden the resin. The resulting product is a film that falls halfway between the so-called thermosetting resins and the typical thermoplastics of the vinyl group.

MOST vinyl type resins require a plasticizer, which results in deformation of the resin at normal operating temperatures of electrical equipment. The Formvar combination on wire raises this deformation temperature to a point beyond the range of normal temperature in electrical equipment and so has made this resin effective. No plasticizer is used, and the flexibility in the film is accomplished by excellent adhesion to the copper and by virtue of the thin film.

✦ ✦ ✦

EXTREMELY large quantities of this type of resin has been used, although possibly not approaching the volume of the vinyl chloride type, since wall thicknesses when extruded are necessarily heavier.

ON page 4 of the paper reference is made to the possibility of changing the properties of the Vinyl Acetals by varying molecular weight and varying the type of aldehyde reacted. Reference should also be made to the possibility of reacting the acetals with other resins, since both the Formvar and the Butvar can be so reacted and do find extensive use as a result of this reaction.

✦ ✦ ✦

ON Page 6 of the paper, referring to the defects of vinyl compound resins, I think with the exception of the vinyl formal that is reacted with the phenolic and which does not contain a plasticizer, all of the other vinyl resins require plasticizers to obtain their flexibility, and this in itself is a defect, since there is bound to be some mitigation and loss of this plasticizer.

ORAL DISCUSSION:

We will now go the next paper on our program which is by Dr. Carl Shapiro on "Insulating Wires with Vinyl Resins". This paper appeared in the October issue of WIRE & WIRE PRODUCTS. We were very fortunate to have it and the one by Mr. Shopmyer printed in this issue, where you had a chance to read them during the convention.

Dr. Shapiro unfortunately could not be here today. I don't feel really qualified to go through this paper, but I have read it over several times in the last couple of days, and I am going to stick my neck out and get it started. We have had some written comments on it. Perhaps one of these gentlemen is present and he would expand on his discussion.

Is Mr. Hall, of Phelps-Dodge Copper Products Company here? How about reading that comment for us, Mr. Rolle?

. . . Mr. Rolle read the comments of Mr. Hall.

Mr. Rolle: I regret I don't understand a thing I have read, but it is rather strange that very little if any mention is made of Formvar or Formex. I know less than nothing about this subject, but I do occasionally run across advertisements of the General Electric Company and some other companies, and very frequently see samples of these insulating materials. So the only question I could have put to Dr. Shapiro would have been "Why didn't you include Formvar?"

Perhaps Mr. Shopmyer or someone else from General Electric can answer that question. It seems to me the gist of Mr. Hall's comments, with all the big words and formulae, is that Dr. Shapiro excluded or omitted one of the important vinyl resins. Is that what you get out of this, Mr. Davis?

Chairman Davis: Yes, I do. Thank you. Somebody, I am sure, has something to say.

Member: I think we are all very much at sea on these various synthetics. We find that Formvar and Formex, to the best of my knowledge, are the same article manufactured by different firms.

In reading this paper, I don't recall seeing any mention made of the percentage of solids present. It seems to me that is rather important, because the percentage of solids in most of these is very low. I should think it would be desirable to arrive at some synthetic in which the percentage is high. I am only in an allied line—machinery, and I don't come directly into the picture. These resins are used in our machines and I should be glad if anybody would give me some information in regard to the percentage of solids and why it doesn't seem important enough to find its way into any of the papers.

Chairman Davis: Does anyone have anything in respect to that? Dr. Shapiro's comments on the patent situation indicate that the patent situation regarding most of these vinyls with their trade names, and so forth, is quite involved and most confusing to the ordinary person. I know it has been to me. He expresses the thought that a great number of newer compounds and modifications of existing types of compounds will be wide open for development and for patenting.

Gentlemen, this is a subject that we should jump right into; I have heard it discussed in some of the rooms, but it's better if we did it here in open session.

Mr. Rolle: There must be something very mysterious about it. I asked half a dozen people to comment on this paper, and some of them were very curt in their declination. I am just wondering what is behind all this. I know one man who is definitely competent to discuss the paper, but he refused. Could you explain that?

Member: No; I am asking for information.

Mr. Rolle: Is it possible that the patent situation has not been cleared up?

Chairman Davis: Ernie Clark, can you tell us about this?

Mr. E. W. Clark: I don't know anything about resins.

Mr. Rolle: You know nothing, and we know less. The rest of us are down in the minus class.

Chairman Davis: This is the age of thermal plastics. We hear about it in Fortune Magazine, and find it in everything we pick up. People are talking about plastics. On the other hand, the plastic industry as a whole, and those who expect to make that their future work, are afraid that plastics will be overdone.

I think the plastic industry or at least a part of it has tried to develop trade names rather than the chemistry of plastics. But that doesn't mean that we, as

a technical group should not discuss these things regardless of trade names and learn something to the benefit of each other.

Mr. Rolle: I can confirm that. Only seven or eight months ago, one of the British companies with which we are very friendly sent a man over from England for only one purpose. He got off the Trans-Atlantic plane, boarded a train and went directly to the General Electric Company plant where he spent two or three weeks studying Formex, and then went right back. I tried to get him to look at other things such as wire drawing machines but he refused, saying he was over here for one purpose, Vinyl Resins for insulating copper wire.

Member: Perhaps he is a victim of being oversold by General Electric [Laughter].

Mr. Rolle: I rather doubt that; it was an expensive and difficult trip and he had to have the information; but it does seem rather mysterious.

Chairman Davis: It seems that way. We have tried to get into the chemistry of this subject and get some discussion on it. Perhaps someone would like to see the method of applying vinyl resins to wire. The Industrial Oven Engineering Company have one of their machines here in this city at the Lens Electric Manufacturing Company, 1751 North Western Avenue. They have an eight-wire unit running there at the present time. If you will contact Mr. Heaps after the meeting I am sure he will be glad to arrange for you to see this machine in operation.

Member: As Dr. Shapiro is not here, I will rise and defend him. Formvar is mentioned in his article.

Mr. Rolle: That is correct; he does mention it, but only very casually.

Member: Casually, and he has it under the acetal types.

Mr. Rolle: That is right. It is so well hidden in the general text that at first reading it slides right by.

Member: I am a field expert for the Industrial Oven Engineering Corporation, and have erected several lacquer towers for insulating wire and cable. I rather hesitate to talk in a chemical way about vinyl resins because of the little I know about them, and I find the more I get into them, the less I know.

As the Chairman has stated, if you would like to view a lacquer tower in operation using vinyl resins, we have one of the largest ones here at Lens Electric Company. I could probably explain its operation to you better over there.

I see that Mr. Gundstrom of Rome Cable Corporation is here. He might possibly want to say something about his lacquer tower.

Mr. E. W. Gundstrom (Rome Cable Corp.): I could tell a little about the equipment, but I know nothing about vinyl resins. They are a mystery to me.

Chairman Davis: Well, let's get Nero Wolfe. We need a good detective to bring out the culprit that is hiding in our midst. If there is no further discussion, we will conclude the morning session.

Member: Mr. Chairman, I think there is a great deal of mystery and certainly a lot of confusion in the plastic industry, and I am not so sure that it has not been brought about by ignorance on the part of both the producers of the material and the users. I personally feel that there is a great future in a great many ways for plastic coverings.

I tried to get the Army to use a vinyl type of covering on our heavy wires at the time when we were very short of crude and Buna rubber, following the English practice. But our Army engineers were afraid of it. However, toward the end of the war there was a great deal of wire produced with a vinyl covering, and had the war continued it would probably have resulted in their using a double extrusion with a polythylene covering as a substitute.

The British Army has used vinyl chloride on their communication wire, which is comparable to our field wire. They had quite a different attitude toward its performance than our Army had. They were perfectly willing to forego electrical characteristics to gain physical characteristics. Our boys insisted on talking 200 miles over a wire in rainy weather that probably should have been good for only about 10 miles under those conditions—but we did do a pretty good job.

I mention these things merely because I feel that at the present time **you** men who are insulators have got to get up and determine what you want in the form of insulation and make the producers of insulation give you a composition which will give you the electrical and physical qualities needed to meet a given end use. Until you tell them what **you** want and require they are going to give you what **they** want.

I don't mean that there is lack of cooperation. I think both sides are working too much in the dark. With modern techniques, I think that you can get almost anything you want, and if you want enough of it the cost will come down to compete with other materials.

I believe if we do that we will have much better understanding among all concerned; that is, the producers of the insulating material, the people that make and insulate the wire, and the third party, the fellows who use the wire. We also have the underwriters' laboratories who have to approve the product.

Chairman Davis: That is like an encore. I said if we tried to adjourn the meeting we would probably get the discussion started.

Member: I might add that Industrial Oven has made up a pamphlet covering some of the bugs that we encountered in lacquering insulated wire and cable. If anybody is interested I shall be glad to give him a copy.

Chairman Davis: Fine. From an equipment angle, I am sure you will want to secure these before you leave the convention.

If that is all, gentlemen, permit me to thank you for your courtesy and cooperation. We also want to thank Dr. Shapiro for his paper in spite of the fact that he was not here to present it.

The meeting recessed at twelve o'clock.

Meeting, Thursday, October 18 — 1:30 P.M.

Chairman of Meeting

Sidney Rolle, Asst. Manager,
Scomet Engineering Company,
New York, N. Y.

Metallurgy of Copper and
Its Relation to Magnetic Wire Manufacture
by W. L. Fleischmann, Section Engineer,
General Electric Company,
Fort Wayne, Ind.
Published November, 1945 — Page 853

Trends in Metallurgy,
by A. Pirk, Metallurgist,
Rome Cable Corporation,
Rome, N. Y.
Published October, 1945 — Page 758

PAPER: Metallurgy of Copper and Its Relation to Magnetic Wire Manufacture

Written Discussion Presented By
H. M. Schleicher,
U. S. Metals Refining Company

THIS interesting paper by Mr. Fleischmann reminds me of one by Clement Blazey, "Experiments on the Electrical Resistance of Copper and Some Copper Alloys," published in the Journal of the Institute of Metals," 1936/88/1. Blazey found that he could modify the electrical resistance of copper wires markedly by a variation in annealing procedure even though in all cases the copper was "dead" soft.

QUENCHING from a high temperature (950° C.) anneal resulted in considerable loss of conductivity. Slow cooling showed a small loss. Maximum conductivity was obtained by annealing at 500° C.

IN discussing the paper, Mr. Preston expressed the regret that work had not been done also to determine the effect of the various anneals on the mechanical since then to prove that Mr. Preston's conjecture was indeed valid—other properties are also affected. Mr. Fleischmann now reveals the practical value of the knowledge gained in this direction during the last ten years or so.

PAPER: Trends In Metallurgy

Chairman Rolle: Gentlemen, this being the final session, I hope that we can have an interesting discussion.

I regret to announce that Mr. Fleischmann told me at the last moment that he would be unable to come here. Mr. Fleischmann's paper was delayed a little, so that Mr. Brown, Editor of WIRE & WIRE PRODUCTS, was obliged to omit it from the October issue, but fortunately he was able to switch papers and program around and get Mr. Pirk's paper in. I think we all have had time to read it, so we shall start by asking Mr. Pirk to give us a resume of his paper, and then I hope we will have some interesting discussion.

Mr. A. Pirk (Rome Cable Corp., Rome, New York) read his paper.

Chairman Rolle: I believe Mr. Pirk brought out one very important point: that it is a good thing every once in a while to go back to fundamentals. No matter how capable or clever you are, it is essential to do that in order to avoid pitfalls. I suggest that we postpone discussion of this paper until we have had Mr. Fleischmann's paper which I shall now read.

Chairman Rolle read Mr. Fleischmann's paper.

Chairman Rolle: It is indeed unfortunate that Mr. Fleischmann is not here to defend his paper against the attacks which I am sure will be made by those who have had experience in this field. As I look around I see two gentlemen who I am sure will want to take issue with some of his statements and I hope that we can have a lively discussion. I myself am in a rather embarrassing position because if I start I surely will be accused of peddling our product. Some of you who were present yesterday will recall the unpleasant episode when one of the furnace people got himself in a jam by filling his discussion with sales talk.

It is getting late, so I suggest we discuss Mr. Fleischmann's paper first, and then if you have questions for Mr. Pirk involving his fundamental resume, let's do it. That may be somewhat brutal, but I believe it will be the best way.

Mr. Pirk: I don't think that is brutal at all; I think it is a break.

Chairman Rolle: Well, it may be brutal to the members here. The normal procedure, of course, would be to take up your paper first.

There are many controversial points involved in Mr. Fleischmann's paper, so I am sure you have some comments to make.

Mr. Clark: I don't think you agree entirely with that paper, do you, Sidney?

Chairman Rolle: Entirely? I think that is putting it rather mildly. As Program Chairman, I suppose I could have rejected this paper for one reason or other, but I thought it best not to be too arbitrary. No, I don't agree with many of the things Mr. Fleischmann has said, but, as I said before, I don't like to be the one to comment on it. Well, if no one will start it—here goes.

As you gentlemen know, we produce oxygen-free copper which, to a large degree, has eliminated some of the troubles he has mentioned. In fact, some concerns don't use tough pitch copper any more at all for fine wire. Another thing which Mr. Fleischmann failed to mention is that there are on the market vertical cast tough pitch copper wirebars: such bars having no set side do not have to be scalped. But for very fine quality wire the shaving of the rod, I think, is now very definitely accepted as good practice.

Mr. Clark: If you would like for me to make a comment, I wish to say I don't agree on this. I think it is a practical point.

Chairman Rolle: Having, so to speak, been brought up in a copper refinery, I am qualified to say that all refineries do maintain close control over their output, but whenever they have to deal with batch processes, it is difficult if not impossible to obtain the uniformity which is possible when the copper is produced continuously.

Another difficulty is that many of the refineries are custom refineries. Their input varies considerably, which means there is quite a wide range in the composition of the anodes which to a degree affects the quality of the cathodes. Then if these cathodes are melted in a reverberatory furnace further variation in composition may arise. So I think Mr. Fleischmann can be criticized for ignoring these points in his paper. However, his comments with regard to the work done by A. S. & R. are quite correct. We have checked some of these results and have found them in conformity with our own.

I suppose Mr. Fleischmann got his information about the refineries while at Fort Wayne, where he compiled the data for this paper. But I rather doubt that in Rome, N. Y., where there are two very fine wire mills whether they would accept some of his statements.

Mr. Clark: You don't think he got it from Mr. Doyle, do you?

Chairman Rolle: Definitely not, because, according to Mr. Doyle, nothing is very uniform, unless it is melted or heated in his furnace. If there are no further comments from the floor, I have written comments here from one of our metallurgists, but I assure you that he had no coaching from me whatsoever.

Chairman Rolle read discussion by Mr. H. M. Schleicher (U. S. Metals Refining Co.).

Mr. Clark: It is a curious thing that they don't mention any time element in the annealing; only temperature is referred to.

Chairman Rolle: That is an important point and shows the difficulty one can get into when the fundamentals are ignored. Mr. Pirk brought that out very well in his paper.

Are there any further comments on Mr. Fleischmann's paper? Do you want Mr. Pirk to get up here to finish reading his paper? He is so full of his subject that he will stay here all night, if we don't watch out.

Mr. Pirk was so very busy at Rome that he was delayed considerably in completing his paper. I submitted it to two or three of my friends who dismissed it and said "School boy stuff." That is an easy way to get out of the job of preparing a written discussion. Intimacy breeds contempt. Personally, I think it necessary to go back to fundamentals every so often. As a matter of fact, I carry with me a little copper handbook gotten out by the Copper Development Association in England, to which I refer frequently. If we got anything out of Mr. Pirk's paper, it is that it is a good thing that basic facts should be reviewed from time to time.

I understand he has some more slides, but as it is getting late, I suggest he go through them very quickly, so that we can wind up the 1945 convention.

Member: Maybe Mr. Pirk would like to comment on the paper just read.

Chairman Rolle: No, I think we had better forego that; he had ample opportunity earlier this afternoon. I feel sure he disagrees with a great deal of it, because his own experience is quite at variance with that of Mr. Fleischmann.

Mr. Pirk presented additional slides.

Chairman Rolle: I think Mr. Pirk has done a very nice job and deserves our sincere thanks. Are there any questions that can be answered rapidly? If not, we will adjourn and so wind up the annual meeting.

The meeting adjourned at five o'clock.

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ATTENDANCE LIST

Wire Association Convention

Chicago, October, 1945

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(Please turn to page 103)

Assisting Postwar Trade

by K. Bernard Wise, England

THE position of the wire industry in the post war era is one of assured success, the potentialities of the product having become universally accepted. In the reconstruction of war-scarred Europe and other lands devastated by warfare, products of wire and wire itself in its various categories will be an essential. The war time expansion will require to be maintained in the days of peace although similarity of products and production do not necessarily follow. Plants will call for readjustment and re-alignment to peace time standards in order to cope with the then demands and to absorb a share of the demobilized Servicemen.

✦ ✦ ✦

THE prospect of post war development along the right lines hinges, however, on one thing and one thing only — FINANCE. Finance for the carrying through of schemes embarked upon, finance for re-equipment and installation and finance for the sales which will be effected. There will be no lack of demand but what will be necessary will be an assisted ability to pay.

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THE more rapidly can credit be expanded, the sooner will come the "war replacement" boom and success in the creation of such a boom must be regarded as an immediate post-peace objective. Of course, following the creation of that boom and the benefits which will accompany it may come the less pleasant aspect of the trade cycles and the ensuing fluctuations. These, however, present a different problem.

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WAR production has been guided and controlled to an hitherto incredible extent but after the war some similar bureaucratic function will require to be maintained although operating on a somewhat different plane. Its then policy will be to hasten the transitory period between war and peace standards by allocating priorities and thus permitting development of native industry in the order of industrial sections and essentialities. Engineering machine tools will probably receive first consideration and the manifold applications of wire products will certainly bring that industry to a place high among the scheduled industries competing for priority consideration.

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HOWEVER, whilst the demand may exist and there be a willingness on the part of manufacturers to play their roles to the fullest extent, inability from financial reasons may hamper many, particularly those whose plants have undergone heavy deterioration from fulfilling war contracts and smaller firms whose finances were never very strong but whose products were of high calibre.

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GOVERNMENTS throughout the Allied Nations have announced an intention to co-operate wholeheartedly in reconstruction plans. A system as briefly outlined below would constitute a major step towards achieving one of the desired objectives—speedy rehabilitation.

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THE re-formed Ministry which has hitherto controlled production and was responsible for supply, should be empowered and enabled to finance contractors and contracts where such assistance is proved necessary and deemed essential. Finance officers would investigate appeals made for such help and powers might even be delegated to approved banking houses to render immediate aid without reference to the Ministry. The initial qualification for such financial aid would be the approval of the contract by the Ministry (or its appointed delegate) as one, the products of which were essential to reconstruction either at home or abroad, but mainly abroad. Actual financial transactions would be undertaken by banking institutions. They, for their work and loans, would be fully secured in that the Ministry would give a full Government guarantee of the fulfillment of the contract or the Ministry might even deposit negotiable Government bonds.

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THE advantages of such a system would rebound to the benefit of the banks whose money would otherwise be locked up and the employability reduced to a minimum by trade conditions. The facilities provided for the Government and through the Government would be charged to Government at a nominal rate—sufficient to cover the out-of-pocket expenses of the banks plus an infinitesimal margin for profit. Progressively, the Government would look to the individual borrower to cover this charge plus only the bare cost of bureaucratic administration.

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SCHEMES for industrial, commercial and international reconstruction should not be permitted on bases which are conducive to the making of huge profits by any section of the manufacturing community. We have all been in this war together whether at home or abroad; we are all vitally interested in getting back to peaceful conditions and

(Please turn to page 100)

The Foreman's Part In Veteran Rehiring

by Lawrence Stessin,
Vice President, Labor Relations Institute,
New York, New York.

REEMPLOYMENT of veterans is becoming less and less a top management problem, and more and more a responsibility for foremen. When the broad outlines of management and personnel policy have been drawn, the hardest task still lies ahead — achieving an orderly absorption of returning veterans into the company ranks.

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THE veteran's right to return to his former job, or to a position of equal seniority, status and pay, providing that he was the permanent holder of the job, and not a replacement, has been established in the courts. The first test case of "super-seniority" — the right of the rehired veteran to displace workers of greater seniority — has also been decided in the veteran's favor. There still are many bothersome wrinkles to iron out, but it seems safe to predict that the spirit and the letter of the G.I. Bill of Rights and the Selective Service Act will be respected throughout the industry.

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THIS is the point where policy ends and practice begins. The decision has been made to rehire every veteran legally entitled to reinstatement, plus, perhaps, every possible replacement who subsequently entered the armed forces. But **Who** is going to see that the job is open when the vet returns? **Who** is going to attend to the details of reinduction and reorientation? **Who** will assume the burden of making the returnee feel at home? If there is to be retraining for the old job, or preparation for a new and better one, **who** will make the decision and execute the follow-through? And **who**, day after day and year after year, will represent the Company in man-to-man dealings with the boys who came back?

THERE are more questions, but only one answer — **the foreman.** He is the determining factor in the success or failure of the reinstatement program. The supervisor has it in his power to fulfill the employer's promises, upon which the former soldier or seaman has banked for the duration, or to sour the entire program through lack of cooperation and consideration. For instance, here are some of the major duties which supervisors must perform, in order to make the reinstatement program a success:

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1. **Classify returning employees according to regular or replacement status.**
2. **Determine the first group's seniority, status and pay.**
3. **Plan ahead for the veteran's return, so that he can be reinstated without delay.**
4. **Smooth out all concurrent problems, such as the displacement of civilian workers to make room for the veterans who are to take over the jobs.**
5. **Reinduct the veterans and give them a "fresh start" toward success on the job—and eventual promotion.**
6. **Help them through the difficult readjustment from military to civilian life.**

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IT will pay to look more closely at each of these important points. Let us take them up in the order given.

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1. Classifying Returning Veterans:

EVERY person who left the firm's employ to enter the service, belongs in either the "regular" or "replacement" class. What amounts to an inventory must be taken to see how many persons there are in each group. Some of this information can be secured from the personnel department records, but it is sound practice to have each record examined by the proper foreman as a check upon its accuracy. An error in determining the status of the veteran could result in litigation. Even "replacements" who have been correctly classified may appeal to Selective Service or the courts, so it is important to have an accurate record.

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2. Determining Status, Seniority and Pay:

THE simplest way to do this is to set up a 5 x 7 card for each employee who joined the armed forces, filling in the name and other available data at the personnel office and then distributing them to the proper supervisors to be completed. Each card should provide space for such specifications as job number, rate, seniority, date of leaving for military service, probable placement after return, plus information as to what must happen to the present worker on that job. Can the latter be used elsewhere in the department, Does he or she have skills which might justify a transfer? Is it desirable to retain this worker in addition to rehiring the veteran who has a claim upon the job?

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3. Planning Ahead for Veterans' Return:

IN each department, the foreman should make up an organization list or chart which assigns a specific job to each potential returned veteran who has been classified as the "regular" holder of a job. It need not be the exact position he occupied before he was inducted, but it must be every bit as good—or better. This chart, of course, will have to be brought up to date as servicemen announce whether or not they plan to return. In the absence of word to the contrary, it is wise to assume that

(Please turn to page 101)

GOVERNMENT WIRE PRODUCTION INFORMATION

Department of Commerce Reports on German Industrial Practice

AMONG a group of new reports containing scientific and industrial information recently announced by the Department of Commerce, Office of the Publication Board, Washington 25, D. C., are several of interest to the wire industry. These are:

Report No.	Price	No. of Pages	Title
480	25c	18	German Cellophane and Other Thin Films.
1239	10c	8	Survey of Continuous Filament Spinning and Textile Processing of Viscose Rayon Yarn.
1353	25c	14	Synthetic Fibers in Germany and Their Applications During the War.
1354	10c	2	Fiber-Forming Polymers and Their Intermediates.
351	25c	28	Report by Harrison M. Brightman, covering among other things hard cemented carbides and cold drawn solid and hollow welding rods by a process said to merit further study.

Make checks payable to the Treasurer of the United States.

✦ ✦ ✦

Fine Wire Price Controls Lifted

AS of November 20th, the O.P.A. announced the suspension from price control of a number of items deemed not to affect the cost of living. Among these were fine and specialty wire and aluminum and magnesium mill products.

A. W. Deller Talks to Students at N.Y.U.

Anthony W. Deller, noted Patent Attorney and member of the New York Bar, gave two talks on the subject, "Patent Problems in Principles and Practices of Industrial Research," before the Graduate Division of the School of Engineering, New York University, on the evenings of December 13 and 20.

✦ ✦ ✦

MR. Deller is Patent Counsel for the International Nickel Company, New York.

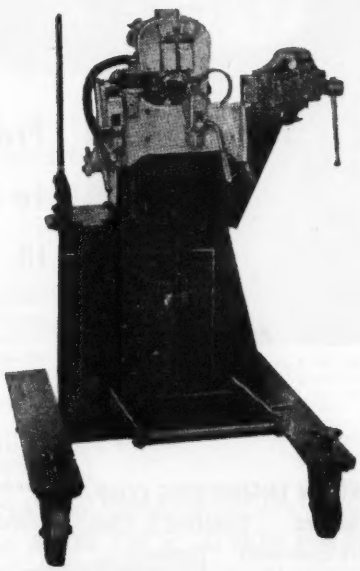
An ADVERTISER likes to know his ads have been read, so please mention WIRE & WIRE PRODUCTS when writing him.

MICROMETER PRECISION MICRO-WELD TRADE MARK REG. U. S. PAT. OFF.

CONTINUOUS IMPROVEMENT

MICRO-WELDERS with dial indicating annealing attachments are now available for high carbon wire.

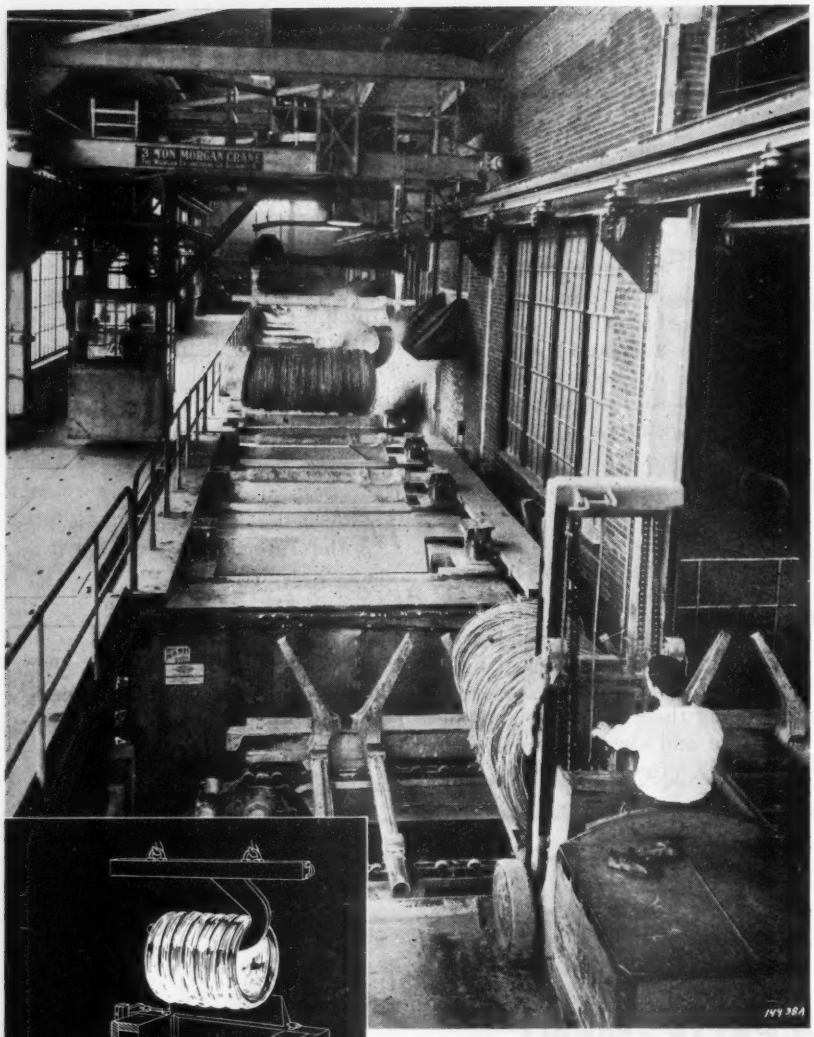
There is positive control of annealing temperature and already hundreds of these special MICRO-WELDERS are proving their dependability and satisfactory performance with leading manufacturers.

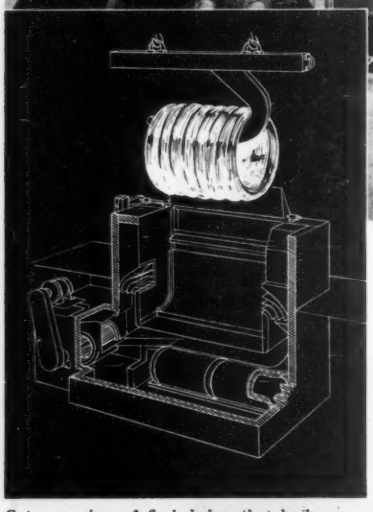


MICRO PRODUCTS COMPANY

20 NORTH WACKER DRIVE, CHICAGO 6, ILL.

Telephone, State 7468





Cutaway view of flash baker that broke a war time bottleneck in the wire industry by accomplishing in minutes what formerly took hours. Over 70 installations involving this basic design are now in operation in every section of the nation.

From CLEANING PLANT to DRAWING BENCH in a matter of minutes

Morrison Flash Baker saves time, cuts costs and speeds up production of wire and rod. The baker achieves a fine coating of lime and accomplishes an almost complete recovery from acid brittleness. The combination results in exceptionally good drawing characteristics.

Call on Morrison wire mill experience for designing and installing the proper baking, coating, galvanizing equipment. The resulting recommendations have been gratifying to many of the largest manufacturers in the country. Call Cleveland HEnderson 6666.

The MORRISON ENGINEERING CORP.
5005 Euclid Ave. Cleveland 3, Ohio

ASSOCIATE COMPANIES
Morrison Engineering of Canada, Ltd. of Toronto, Ontario
Carrier Engineering Company, Ltd., of London, England

FURNACES
MORRISON
PATENTING
COATING
OVENS
GALVANIZING
IMPREGNATING

How Neoprene Overcomes Weak Spot Telephone Systems

A TELEPHONE conversation may speed over miles of cable and through dozens of relays and switchboards, only to come to grief on a slender pair of wires which spans the short distance between the pole in the street and the wall of the subscriber's house. This is the "drop wire" or "loop", and, because of its exposure to sunshine, rain, sleet, snow, rubbing tree branches and contact with buildings, it suffers more than any other link in the circuit.

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HOWEVER, this Achilles heel of the telephone system is now being shod with tough neoprene, Du Pont's synthetic rubber, and tests indicate this extra protection will make "out of order" reports much less frequent in the future. Neoprene-jacketed drop wires developed by the Whitney-Blake Company of New Haven, Conn., manufacturers of telephone wire since 1899, are being installed in a number of communities throughout the country. They have been given the name of "Teleprene."

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WHEREAS the main telephone cables are well protected against almost every conceivable influence and contingency, the "drop wire" must be light and flexible, installed under many unpredictable conditions and yet capable of standing up under more abuse than the cable.

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THE neoprene jacket is applied over the rubber insulation and is designed to protect the wire from all these damaging influences. Neoprene is highly resistant to abrasion, heat, sunlight, cold, acid fumes, moisture, and injury by mold and bacteria. And its excellent compression strength makes it less likely to crush where it is gripped by the telephone clamps, which support the wire at the house and the pole. Another feature of the "Teleprene" wire is the unusually good adhesion between the wire itself and the rubber insulation. This is achieved by an electroplating method known as "Teleplate."

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BECAUSE of these advantages over the standard types of drop wire, "Teleprene" is recommended

for use under the worst service conditions, and its adoption is expected to reduce greatly the maintenance cost in the field. To the subscriber this means fewer interruptions in his telephone service.

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THE neoprene-jacketed wires are being produced in several types. There is a parallel wire construction in which the two wires are encased by a neoprene coating as a single unit, and the twisted pair arrangement of two separate wires. Each of these types is available with or without fabric reinforcement under the neoprene cover.

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Folder Describes Incentive Pay Plan to Solve Pay Problems for Both Labor and Management

TO acquaint management and employees with a new type of plant-wide incentive pay plan which automatically raises employee earnings in proportion with production increases, The Eddy-Rucker-Nickels Company, Management Counsel, Cambridge 38, Mass., has published a comprehensive outline of the Rucker Share of Production Pay Plan. The Share of Production Plan is based upon the principle established in Allen W. Rucker's book, "Labor's Road to Plenty."

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THE Plan has enabled employees in two concerns to increase their earnings up to 33% and 39%, respectively. These increases were paid out of values created by the employees themselves, without increase in unit costs and without price increases.

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COMPANIES now using the Plan have been able to reduce absenteeism, labor turn-over and material spoilage, to keep cost down, and at the same time to increase production and take-home pay substantially.

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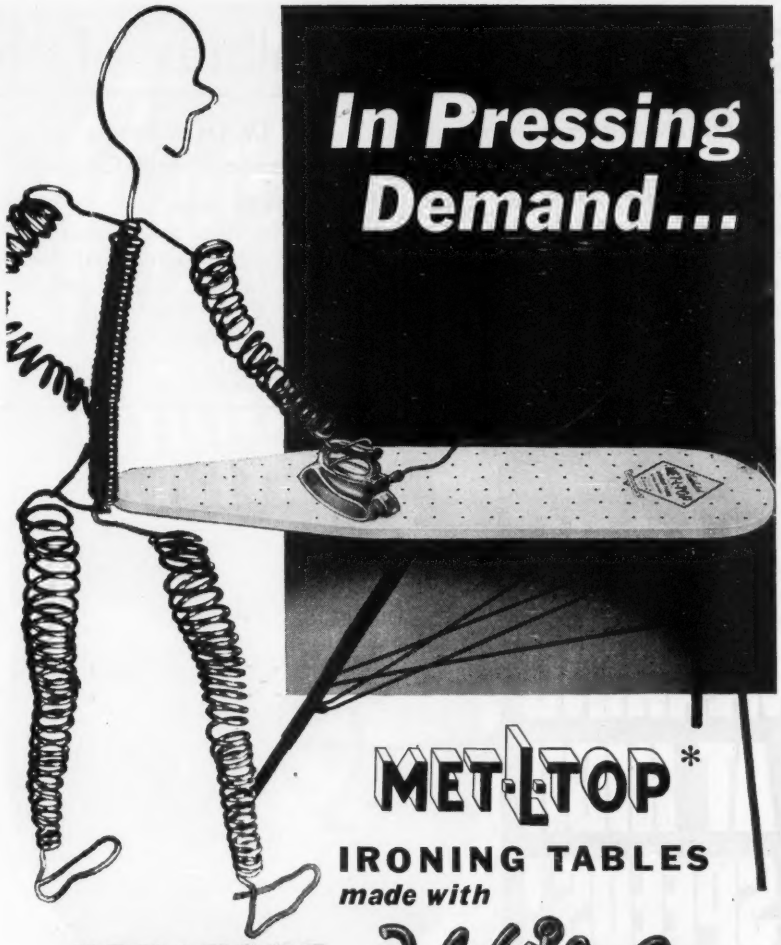
UNDER the Plan's operation cumbersome bookkeeping and efficiency ratings can be avoided; no changes in prevailing wage rates are required; promotions and pay increases on merit are encouraged; and, labor and management are both protected against arbitrary changes in wage rates in the event of inflation or deflation of the price level. A copy may be obtained directly from the publishers at no charge.



Here's a new type ironing table that won't burn if she forgets to unplug the iron when the phone rings. It is all steel, with ventilated metal top . . . provides faster ironing, is fireproof, warp-proof, light in weight and practically indestructible.

The improvements built into this new type ironing table clearly indicate the superior planning behind it. Another indication, too, is in the materials used. We are indeed proud that Keystone wire was chosen to add its bit to the quality and durability of this *better* ironing table.

*GEUDER, PAESCHKE & FREY CO., MILWAUKEE, WIS.

KEYSTONE STEEL & WIRE COMPANY

PEORIA 7, ILLINOIS

Special Analysis Wire for All Industrial Uses

SAMSON SPRING WIRE

Coppered, Tinned, Annealed, Galvanized

Outstanding Personalities of the Wire Industry

Edward Edmunds Joins Ajax Electric Co.

THE **Ajax Electric Company,** Philadelphia, 23, Pa., has announced the appointment of **Edward Edmunds** to the post of Chief Metallurgist for the Company, which is one of the outstanding manufacturers of salt bath furnaces.

Dr. Dean Joins International Nickel Co., Inc.

DR. **John G. Dean** is now with the Development and Research Division of the **International Nickel Company, Inc.,** 67 Wall Street, New York, N. Y., as Senior Fellow-in-Absentia of Mellon Institute of Industrial Research, Pittsburgh, Pa.

Pierce Goes To Allegheny Ludlum

DEVELOPMENT work on new applications of stainless steel and other alloy steel products is to rank high on the Allegheny Ludlum Steel Corporation's postwar program.

✦ ✦ ✦

CONCURRENTLY with the formation of a sales development department, to integrate and intensify product application and new development activities, the company announces the appointment of **W. B. Pierce** to head the department. Under his direction, a staff of technically trained engineers will assist manufacturers in the solution of problems involving applications of stainless steel and related alloys.

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MR. Pierce, widely known to the stainless steel industry and consumer trade, had been with the Rustless Iron & Steel Corporation, Baltimore, since 1937, as manager of market development. He previously was associated with the development division of the Aluminum Company of America, Pittsburgh and New Kensington, Pa.

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Laclede Appointments

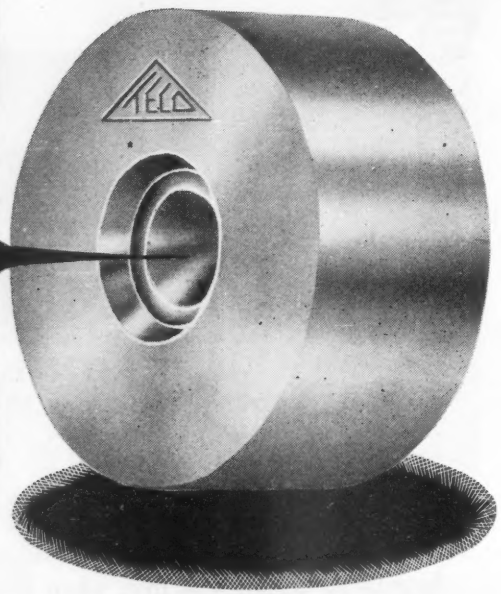
J. W. Gething has been named general superintendent of Laclede Steel Co., at Alton, Ill., succeeding **Lafayette Young,** who recently was appointed vice president.

✦ ✦ ✦

American Steel & Wire Co. Announcements

Stephen B. Metcalfe has been named special engineer in charge of rope plant development, **American Steel & Wire Co.,** and will be located in the chief engineer's office in Cleveland. **A. J. King** has been appointed general superintendent of the New Haven and Trenton works and will center his activities at New Haven. **Charles R. Chase** has been made superintendent of the Trenton works, succeeding Mr. King.

S-L-O-W WEARING AT HIGH SPEEDS!



TECO Cemented Carbide wears slowly and smoothly because an intensely hard, uniformly dense structure provides greater resistance to friction in high-speed wire drawing. As a result, you get longer runs of smooth, on-size wire. Less time is lost in unproductive die changing. Costly reject runs due to pitting and cracking are eliminated.
Equipped with TECO Carbide Dies, your machines produce more tonnage per day, more tonnage per die, at lower cost. A test run offers conclusive proof. Let our engineers know your requirements.

WIRE and BAR DIES
SIZING DIES — EXTRUDING DIES
TUBING DIES
Carbide Blanks, Tools, Bits,
Reamers, Broaches, Forming Tools

ARMY E NAVY

TUNGSTEN ELECTRIC CORPORATION — 564 39th St., Union City, N. J.
Branch Office: 2906 Euclid Avenue, Cleveland, Ohio
Representative: Architects & Builders Bldg., Indianapolis, Ind.

TECO
Pioneers in Tungsten Carbides for over a Quarter Century
CARBIDE DIES

Ajax Electric Company Organizes for Export Business

THE **Ajax Electric Co.** of Philadelphia, manufacturers of electric salt bath furnaces, has recently announced the formation of a subsidiary organization known as the **Ajax International Co.** This new firm is to handle the parent company's growing volume of export business, principally in the Latin-American countries.

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THE Ajax Electric Co. has long held an important position in the metal industry as manufacturers of electric salt bath furnaces for hardening high speed steel tools, carburizing, annealing, austempering and martempering, cyaniding, nitriding, brazing, and other allied operations.

✦ ✦ ✦

OFFICERS for the new company are Dr. G. H. Clamer, Chairman of the Board; William Adam, Jr., President; Leon B. Rosseau, Vice President; John E.Haig, Secretary; E. A. Ginkinger, Treasurer.

✦ ✦ ✦

Feely Takes Charge of Westinghouse Company's Electronic Component Manufacture

Frank J. Feely, manager of Western Electric Company's Specialty Products Shops in New Jersey, has been appointed manager of the Company's electronic components manufacture, according to a recent announcement by C. G. Stoll, president. These manufacturing operations will be moved into a new plant to be constructed during the coming year at Allentown, Pa. Since 1942 Mr. Feely has been responsible for much of Western Electric's production of radar and other electronic equipment for the Armed Forces, and brings to his new assignment 25 years of manufacturing experience in the Company.

✦ ✦ ✦

J. M. Newman Promoted by Cutler-Hammer

John M. Newman was recently appointed General Engineering Supervisor over Steel Mill, Machine Tool, Brakes and Drum Controller divisions of Cutler-Hammer, Inc.

The prevention of Pickle Brittleness is but one of the many reasons why Rodine is so generally used throughout the pickling industry.

RODINE minimizes embrittlement by confining the action of the pickling acid to the removal of scale thus minimizing acid attack on clean metal and the evolution of hydrogen that is responsible for this and other pickling troubles.

RODINE — a selective inhibitor — effects material savings in pickling. The saving in increased tonnage of pickled metal and in the amount of acid consumed far exceeds the cost of the Rodine used. This will be a material aid to profitable production for the postwar production.

Below are a few advantages of the RODINE inhibited pickle bath:

- Less acid required to pickle a given weight of metal
- Less metal wasted in pickling
- Less overpickling
- Less embrittlement
- Less rejections for bad pickling
- Less coating metal needed
- There are many others!

There are types of RODINE suited to the varying pickling problems. The experience of ACP Technicians is at your service to recommend the Rodine application best suited to your needs.

"Efficient Pickling," a new 75-page bulletin of valuable information for picklers, will be sent free on request. Address Dept. D-1.

MANUFACTURERS OF INHIBITORS AND METAL WORKING CHEMICALS

AMERICAN CHEMICAL PAINT CO.

ACP

AMBLER — PENNA.

Office and Warehouse 3665 Palmer Ave., Detroit, Mich.

Canadian Office and Factory Walkerville, Ontario

DISTRIBUTORS

West Coast: Leon Finch, Ltd., 728 E. 59th St. Los Angeles, Cal.

Metropolitan New York Area: Bricker & Andes, 318 Atlantic Ave. Brooklyn, N. Y.

Eastern Ontario and Quebec: Van Camp Products & Sales Co., 177 Parliament St., Toronto, Ont.

Carbide Die Mold Company Appointments

TWO new executives, both well qualified by their previous long experience in the tungsten-carbide field, have been added to the staff of Carbide Die & Mold Company.

✦ ✦ ✦

William C. Uecker is made Treasurer and Sales Manager. **Ernest G. Merlin** becomes Secretary and Sales Representative. Both new appointees left responsible positions with a McKeesport, Pa., carbide manufacturer to go with this Pittsburgh maker of carbide dies and molds, wear parts, and special tools.

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MR. Uecker's educational background includes Penn State courses in shop engineering and also Carnegie Tech studies in commercial engineering. His 16-years' carbide experience goes back to the very inception of such material at Firth-Sterling Steel Company. There since 1929, he worked in the carbide shop, engineering development, and sales. After having been in charge of carbide-tool engineering for 10 years, he became chief development engineer of the newly formed Diecarb division.

✦ ✦ ✦

MR. Merlin, also educated in engineering, learned production at Mesta Machine Company—then went to Firth-Sterling's carbide tool division in 1930. His 15-year duties there ranged over various positions in carbide-tool production and sales. His final capacity in McKeesport was office manager of the entire carbide sales department, which covered dies as well as tools.

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ACQUISITION of these two key men, according to President Jess W. Spiker, will help his company improve and expand its existing services to the powdered-metallurgy industries in the solving of compacting problems and in the plastic development of wear-proofing molds and dies.

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DuPont Makes Changes

Robert L. Richards, who has been assistant manager of the Cellophane Division since May 1, 1944, has been appointed manager of the Nylon Division, it was recently announced by **E. I. du Pont de Nemours & Company.** He succeeds Charles A. Cary, whose appointment as assistant general manager of the Rayon Department has also been made.

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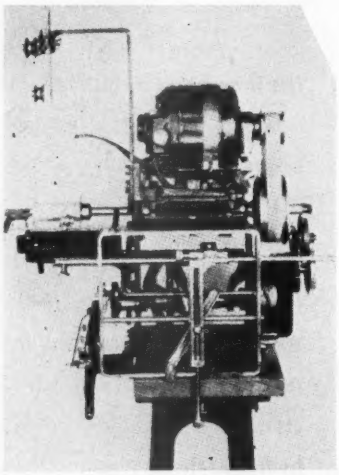
Arlington Kunsman, director of production of the Rayon Division since December 1, 1937, succeeds Mr. Richards as assistant manager of the Cellophane Division.

✦ ✦ ✦

Clark P. Bowman New Production & Traffic Mgr., Hanover Wire Cloth Co.

Clark P. Bowman has been appointed production and traffic manager of the **Hanover Wire Cloth Co., Hanover, Pa.** Mr. Bowman has been associated with the company for 15 years and was previously shipping clerk and supervisor of the shipping dept.

STANDARD UNI-DRIVE WIRE WINDER



Increase your production with this winder. Incorporates many valuable new features. Winds up to 10 ends on each spool. New micrometer variable traverse motion winds evenly between heads. No more hollow shaped spools or bunching of wire next to heads. Geared wind produces straight parallel wind which eliminates jumping of guide on braider latch. Starts slow. Makes possible greatly increased production.

Main drive belts done away with. Traverse variation from 1/2" to 6" between heads without changing cam. Equipped with 1/4 H.P. A.C. motor for 110 volts, 60 cycle current, single phase.

Over 300 of these winders in successful operation. You should have full information on this winder in your files. Please write to nearest office for particulars.

STANDARD MILL SUPPLY CO.

P. O. BOX 1534, PROVIDENCE, R. I.

Plant and Offices: 1064 - 1090 Main St., Pawtucket, R. I.

Southern Office: Southern Standard Mill Supply Co., 512 W. 4th St., Charlotte, N. C.

New York Office: 1022 Empire State Bldg., 350 Fifth Ave., New York, N. Y.

Nathaniel Warshaw Heads Materials Handling Division of Market Forge Company

LONG known as a specialist and a Consulting Engineer in Materials Handling equipment, Mr. Warshaw brings to the Market Forge Company a large experience.

✦ ✦ ✦

MR. Warshaw has a background of achievement in the Engineering field and has been a pioneer in the development of several well-known production processes and fabricating techniques, such as arc welding and employment of high pressure hydraulics. His inventions are numerous and have contributed greatly to the entire materials handling industry.

✦ ✦ ✦

Hoyt Given New Post by Roebling

Firman G. Hoyt, salesman for the past six years at the Los Angeles Branch of **John A. Roebling's Sons Company,** has been promoted to the position of Product Sales Manager of the Woven Wire Fabrics Division of the Company at Trenton, N. J.

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HE succeeds W. K. Paff, retiring after fifty years' service with the Company.

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Keystone Steel & Wire Appointments

George W. Racine, previously assistant secretary and assistant treasurer, was elected secretary and assistant treasurer, **Keystone Steel & Wire Co.,** Peoria, Ill., at a recent meeting of the directors. **Alvin L. Ackerman** was made assistant secretary.

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Reynolds Wire Company Announcement

MR. **Norman J. Froelich,** formerly with the **Keystone Steel and Wire Company,** has joined the sales force of the **Reynolds Wire Company** at Dixon, Illinois, and will be in charge of their Chicago office.

WHILE still employed by the Keystone Steel and Wire Company, Mr. Froelich was loaned to the Wire Branch of the Steel Division of the War Production Board for one year and a half, where he had extensive contacts with the steel industry.

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Mr. **H. Allen Sisson,** formerly with the Michigan Wire Cloth Company at Detroit, has joined the sales force of Reynolds Wire Company and will be in charge of their Detroit office. Mr. Sisson has had extensive experience in the industrial cloth field and is well known in the Detroit area.

✦ ✦ ✦

Hanover Appoints Bemiller

J. Edward Bemiller has been appointed Chief Technician and Superintendent of the plating department of the Hanover Wire Cloth Company. Mr. Bemiller has been associated with the firm for 23 years and was previously foreman of the department.

All-Metal WIRE SPOOLS

CABLE SPOOLS . . . for Insulated and Rubber Covered Wire, Solder, and similar products.

These spool ends are formed from cold rolled steel of gauges to meet specific demands for strength. The edges are curled and ribs embossed for increased rigidity. Panels may be worked into your design and embossed, for use in marking size and variety. All parts are lithographed for identification purposes and to protect the metal.

Ends and traverses may be shipped unassembled. A simple operation on a hand, foot, or power press makes rigid and permanent assembly.

Made in 5", 6½" and 10½" diameter Ends; Traverses 1 15/16" diameter (or special 3½" diameter for 10½" End), in any desired lengths.

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A Review of Recent Wire Patents

No. 2,388,231, TRANSMISSION CABLE, patented November 6, 1945 by Charles A. Arens, Chicago, Ill., assignor to Arens Controls, Inc., Chicago, Ill., a corporation of Illinois.

✦ ✦ ✦

Along the wire cable are secured spaced-apart, egg-shaped bearing members, being spaced apart a distance less than their axial length, and enclosed by a sheath along which they may slide.

✦ ✦ ✦

No. 2,388,319, CROSS-LINKED POLYESTERS AND ELECTRICAL CONDUCTORS CONTAINING THEM, patented November 6, 1945 by Calvin S. Fuller, Chatham, N. J., assignor to Bell Telephone Laboratories, Incorporated, New York, N. Y., a corporation of New York.

✦ ✦ ✦

Covering the wire conductor is a layer of fibrous material impregnated with the cross linked polyesters of the specification, the polyesters possessing sufficient crystallinity and a sufficient degree of linear growth to impart the property of cold drawing when in the form of thin filaments.

Complete Descriptions and Drawings of Patents May Be Had for 25 cents; outside United States and Canada, $1.00. Address, Wire & Wire Products, 300 Main St., Stamford, Conn.

No. 2,388,537, METHOD OF MAKING SPRINGS, patented November 6, 1945 by Charles A. Hallstrom and Raymond E. Tibbetts, Worcester, Mass., assignors to The American Steel and Wire Company of New Jersey, a corporation of New Jersey.

✦ ✦ ✦

The method is said to produce a coil spring devoid of dead, inactive coils at the center.

✦ ✦ ✦

No. 2,388,612, SCREW MACHINE, patented November 6, 1945 by William E. Joyce, William H. Himes, and Delbert I. Wilson, Dayton, Ohio, assignors to The City Engineering Company, Dayton, Ohio, a corporation of Ohio.

✦ ✦ ✦

Included in the assembly is safety means for stopping operation of the machine in the event the drive belt leaves an idler pulley associated with the drive.

No. 2,388,630, WIRE-COILING APPARATUS, patented November 6, 1945 by Charles R. Bergevin, Torrington, Conn., assignor to The Torrington Manufacturing Co., Torrington, Conn., a corporation of Connecticut.

✦ ✦ ✦

The feed rolls, an arbor, a rotary coiling abutment, and means for controlling the relative rates of rotation of the feed rolls and rotary abutment coact to effect, successively, the feeding of the wire stock, formation of the stock into an arcuate portion and the feeding of a further portion of wire stock which is continuous with the arcuate portion.

✦ ✦ ✦

No. 2,388,882, SPRING ASSEMBLY, patented November 13, 1945 by George E. Taylor, Chicago, Ill., assignor to Samuel E. Sosna and George E. Taylor, jointly, as trustees.

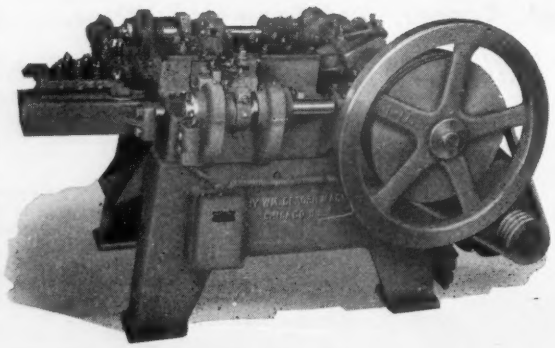
✦ ✦ ✦

This is a bendable slat and coil spring assembly, with cross wires, secured to the upper end convolutions of the springs, by tie wires. There are 11 claims.

✦ ✦ ✦

No. 2,389,109, SPRING WINDING MACHINE, patented November 13, 1945 by Arthur A. Weisburger and Edward G. Glick, Hammond, Ind., assignors to American Steel Foundries, Chicago, Ill., a corporation of New Jersey.

GLADER HIGH SPEED WIRE NAIL MACHINE



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A volute coil winding machine is provided including new means for stripping the coil from a mandrel.

✦ ✦ ✦

No. 2,389,336, MACHINE FOR WINDING THE STATORS OF ELECTRIC MOTORS, patented November 20, 1945 by Otto Wirth, Zurich, Switzerland, assignor to Micafil Ltd. Works for Electrical Insulation and Winding Machines, Zurich, Switzerland.

✦ ✦ ✦

More specifically, the machine winds slotted stators for electrical devices. There are 33 claims.

✦ ✦ ✦

No. 2,389,443, COIL HANDLING APPARATUS, patented November 20, 1945 by Edward L. Lyle, Maryville, Tenn., assignor to Aluminum Company of America, Pittsburgh, Pa., a corporation of Pennsylvania.

✦ ✦ ✦

The apparatus is adapted for elevating and supporting coiled strip for unwinding.

✦ ✦ ✦

No. 2,389,529, WIRE CONTAINER, patented November 20, 1945 by Robert P. Messenger, Kenilworth, and Lee H. Kaupke and Russell R. Raney, La Grange, Ill., assignors to International Harvester Company, a corporation of New Jersey.

✦ ✦ ✦

Adapted to permit withdrawal of a single strand of wire, the assembly includes a central guide having a downwardly and inwardly curved flange conducive to easy passage of a strand of wire.

No. 2,389,838, METHOD OF SCALING STAINLESS STEEL, patented November 27, 1945 by Alfred W. Bromberg, Gary, Ind.

✦ ✦ ✦

Prior to annealing, the hot rolled strip is coated with an aqueous solution containing sodium chloride and sodium fluoride in varying amounts up to the eutectic mixture thereof, and then the coated strip is annealed in a reducing atmosphere, whereby to promote increased scale formation of a character readily removable by acid pickling and in an amount sufficient to effect substantial removal of surface defects from the strip.

✦ ✦ ✦

No. 2,389,878, STRAND ENGAGING DRUM, patented November 27, 1945 by Daniel D. Symmes, West Haven, Conn., assignor to The American Steel and Wire Company of New Jersey, a corporation of New Jersey.

✦ ✦ ✦

A capstan drum is provided for shaped, flexible strand and characterized by having multiple, circumferential grooves in its periphery with a portion of these grooves at its high-tension end shaped to fit the strand and support it against deformation due to its pressure against the sides of these grooves and a portion of these grooves at its low-tension end V-shaped so the strand wedges therein due to its pressure against the sides thereof to obtain enhanced frictional engagement with these sides.

No. 2,390,011, NAIL CLEANING APPARATUS, invented November 27, 1945 by William Thompson, Cleveland Heights, Ohio, assignor to The American Steel and Wire Company of New Jersey, a corporation of New Jersey.

✦ ✦ ✦

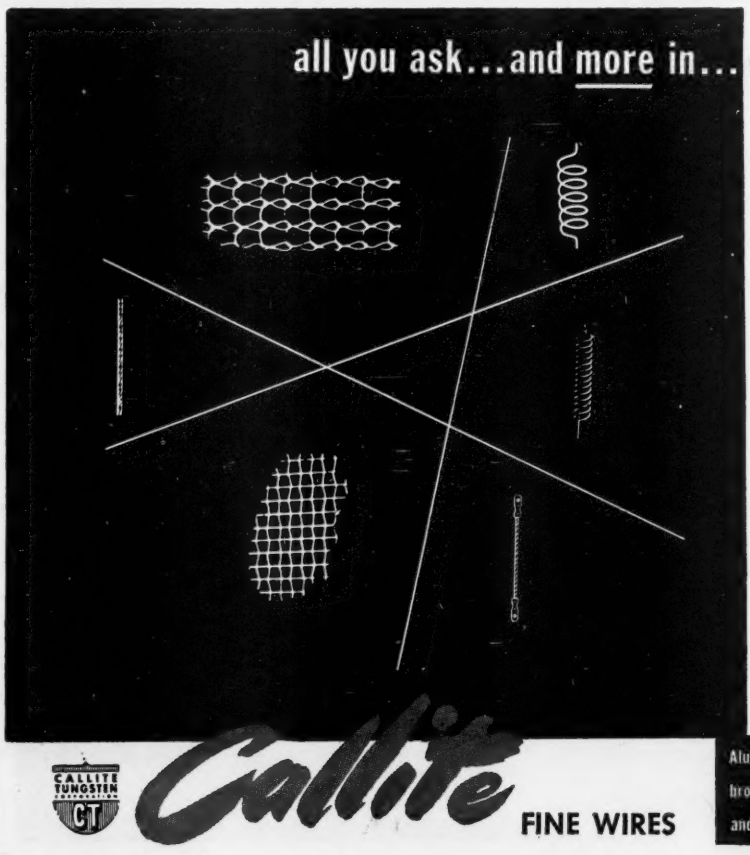
The apparatus includes a drum having interior helical fins a converging outlet wall, and flanged nail-receiving scoops in endwise abutting relation to the fins. As the drum rotates, the forwardly falling mass of nails from the scoops is caused to cascade over the rearwardly falling mass sliding down the converging wall to thus cause a vigorous scouring interaction to take place between the nails and the cleansing agent.

✦ ✦ ✦

No. 2,390,039, INSULATED ELECTRICAL CONDUCTOR, patented November 27, 1945 by Games Slayter and Allen L. Simison, Newark, Ohio, assignors, by mesne assignments, to Owens-Corning Fiberglas Corporation, a corporation of Delaware.

✦ ✦ ✦

Invention resides in the covering for the wire conductor, comprising an inner layer of unwoven alkaline-free glass fibers of the staple type adjacent the wire and an outer layer of alkaline-free glass fibers of the continuous type, the layer of unwoven glass fibers forming a resilient backing for the outer layer, and a coating of insulating varnish on the outer layer of glass fibers, the insulating varnish impregnating the inner and outer layers of glass fibers of different types.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W. A. Technical Discussions Oral Discussion of Morral Paper

(Continued from page 48)

Chairman Braley: When it hits the pan.
Member: Oh, no, not the way I was going to do it.

Member: We have tried that also with other mixtures and tried it by floating the mixture on top of the bath and letting it float on a tub and heating the tub separately from the bath and bringing the wire down through it. We have done that, too, and also, taken the wire out the same way. You can do that. But it isn't practical. It is just a matter of trying to see what you can do.

Member: You would probably have to blow steam on the smelter kettle to keep the temperature down because the wire would carry heat into it faster than radiation would take it away.

Chairman Braley: The proper way is to make an adjustment so your wire enters the bath at the same temperature of the bath.

Member: That is not an annealing temperature. It would have to enter hotter than the bath.

Chairman Braley: Any further questions. Do you have any further comments, Dr. Morral?

Dr. Morral: No, I don't think so. I appreciate Mr. Adam's written discussion and that contributed by the members here.

Chairman Braley: If there is no further discussion then for this afternoon, I think we will call the meeting to a close.

W. A. Technical Discussions Oral Discussion of Talmadge Paper

(Continued from page 51)

Member: What type wire was that?
Member: 18 and 8.

Chairman McCarthy: Any further questions or suggestions as to how we can solve this problem?

Member: I would like to make a few remarks, Mr. McCarthy. This last year I was in Germany and their industry seemed to stress very much the matter of controlled deflection. I think there is a relationship between the casting and the controlled deflection and straightening. As Mr. Talmadge brought out and I think as the curves will show, that he was heating in the brittle range, up to 400 or 450, and they seemed to stress the point that it was important in relation to the cast that they control the deflection or straightening. That is in connection with this gentleman's remark a moment ago about the closeness of your yield to your tensile. It is an important point in there. That is the place where you have to do what they call the straightening. You almost have to flatten in the blocks in preference to bending.

Chairman McCarthy: Any further remarks? We want to be sure everybody has their opportunity. This is your day in court. If not, we will move to the next paper.

W. A. Technical Discussions Oral Discussion of Loux Paper

(Continued from page 63)

remark. Is it feasible to use atmosphere made from gas, let's say, that will contain CO_2 water vapor, and put charcoal in the furnace and compensate for the CO_2 and water vapor and not have decarburization?

Mr. Whitten: It wasn't the intent of my comment to indicate that charcoal had been used to prevent decarburization in a furnace where a special atmosphere was also used. In this particular installation the material being processed was tool steel with scale on it as it comes from the hot mill. Material of this type is so brittle after hot rolling that it cannot be pickled before annealing so the anneal must be made with the scale present unless it could be removed by shot blasting which is usually not done. To utilize the oxygen present under the furnace bell, dried charcoal was placed on the base with the charge. Before active decarburization could take place by further combination of the oxygen, the oxygen was combined with the charcoal in the form of CO.

We have never taken an actual analysis under the furnace bell to know what the final gas constituents are, but the results are that the material with the hot mill scale on it is not decarburized further than the depths present, as the material comes from the hot mill.

It is thoroughly possible to take a cracked gas or partially cracked gas or

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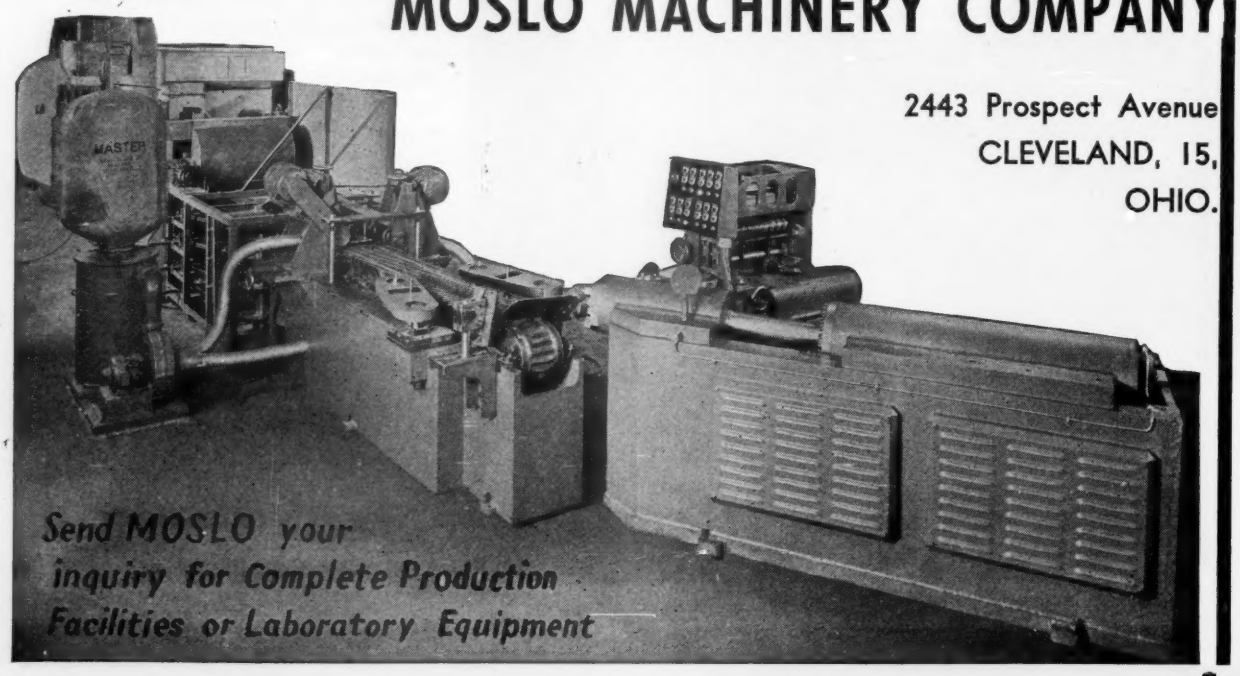

gas burned to almost complete combustion and strip a certain percentage of the CO_2 from the gas so that the resultant product would have both CO and CO_2 present. The ratio between these two materials could be controlled to be approximately .25, that is, with the CO four times greater than the CO_2. Gas containing these elements in the ratio indicated should not be decarburizing to material, either alloy or high carbon analysis with the mill scale on it. Some experimentation would probably have to be conducted in the field to determine the exact gas analysis but the range in which the analysis has to be placed is known and it is only necessary to work within this range for several charges to determine the analysis which can be used subsequently.

Chairman Seymour: Is anybody willing to discuss my question of a little while ago of what has been done to shorten the annealing time for spheroidizing?

Member: Mr. Seymour, we have had some experience along that line although not in the round wire game. A lot of you people recognize that we make a lot of high carbon spheroidized annealed strip. There is considerable bending and forming that has to take place on this strip. In other words, in spheroidized annealed high carbon strip you just can't have any pearlite in it and bend it.

Now, following the original work of Tyson and the rest of the boys up at Crucible Steel, which is what I think we are alluding to by going up to high temperatures and coming down and getting an isotherm on spheroidized. we haven't had any luck. First of all, you have to recall, however, that we are making plain carbon steel and we have no alloying agents to assist us in holding back the formation of pearlite. The reason we don't do it, I believe we could do it in the laboratory, but the reason we couldn't do it in the mills is because of the bulk or size of the charge and the length of time it took to change the temperature within the charge. For example, if you take a charge, 10,000 pounds, and take them above a critical slightly to austentize them to some degree and cool them at the predetermined amounts; that is, 20, 25 or 30 per hour, our experience is that you can't get uniform conditions throughout the charge and several years ago we gave up trying on a plain carbon steel of about .65 or .70 carbon. That is about the only contribution that we can make towards the effect of spheroidization.

I agree thoroughly with the gentleman in the rear and all the others who have maintained that equalization of air at the surface is by diffusion from the inside out because that will occur in the absence of any CO_2 or CO. That will happen where obviously the carbon has to come by migration from the inside to the surface.

✦ ✦ ✦

Written Discussion of Donachie Paper by J. Ogden, Works Mgr., Little Falls Alloys Company

(Continued from page 72)

STRAND annealed wires in sizes of .036 to .005" dia. are now being made commercially, to produce a minimum tensile strength after hardening of 300,00 p.s.i.

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✦ ✦ ✦

THE field for so-called "homogened" wire is quite wide. A good deal of interest is developing in the use of Beryllium Copper manufactured in this form. It is our thought, however, that the properties developed by this treatment do not permit the replacement of age hardened wire by "homogenized" wire in most applications.

✦ ✦ ✦

IT is very possible that further investigation of processing tech-

(Please turn to page 96)

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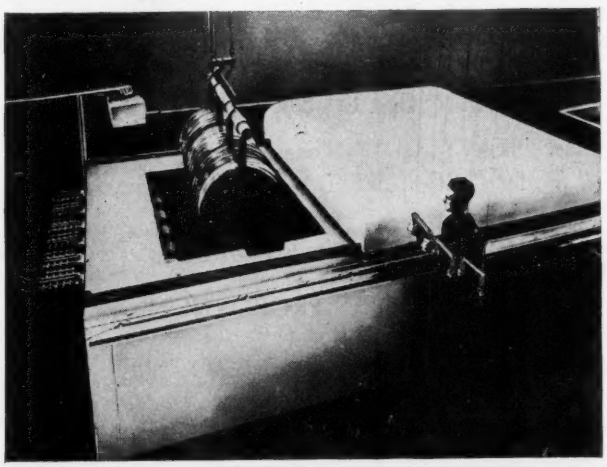

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Written Discussion of Donachie Paper by J. Ogden, Works Mgr., Little Falls Alloys Company

(Continued from page 95)

niques will produce a Beryllium Copper Wire having properties similar to heat treated wire without the user having to age harden.

✦ ✦ ✦

THE development of such a wire should greatly accelerate the use of Beryllium Copper wires.

Oral Discussion of the Donachie Paper

(Continued from page 74)

of a bad casting, and in copper we have proved that very conclusively. I am very glad to hear that Mr. Donachie confirms that in the alloys.

We have great hopes that some day we will be able to get that theory followed by practice. That is, first, starting out with a very pure metal, and then casting under controlled conditions of atmosphere and temperature, taking that metal and preventing oxidation right up to the last stage of casting. By that means you can prevent all sorts of contamination.

We have cast copper that way, going up to many thousands magnifications. While we do find a slight amount of porosity due to the fact that the metal is cast in atmosphere other than oxygen, it is definitely free from contamination and the casting is much better.

Mr. Patterson: In regard to Figure 3, the formation of that beta network. I was wondering how much you can safely go above 1,475 before getting that beta phase network? Does slight overheating cause that?

Mr. Donachie: You can go up to 1,520 in comfort. However, in commercial work we would rather play it 50 degrees safe.

Dr. F. R. Morral (American Cyanamid Corp., Stamford, Conn.): The speaker expressed doubts as to the use of salt baths for the annealing of copper alloys. All those people who work with corrosion are very well aware that what is good for one man is poison for another. The same thing holds true in this matter of salt baths.

It was pointed out by the speaker and also by one of the gentlemen who made a comment that severe corrosion occurred. The commentator indicated the nature of the salts used, which was a chloride carbonate mixture. I would like to ask Mr. Donachie if he has any idea of what kind of salt he used?

Mr. Donachie: We have used mixtures of the same kind used by Mr. Freynik—that is, chloride and carbonate and also nitrates mixed. The Beryllium Corporation has spent quite a few years in the hope of developing a salt for use in our work. We have tried many commercial salts and some we have tried to compound for our own purpose. We have tried particularly to develop a salt for high temperature annealing.

Chairman Rolle: Mr. Burke, would you like to give us a few comments?

Mr. Burke: I don't know why you are doing this to me, unless you are getting even with me for something. I don't know a great deal about drawing copper-beryllium.

I had one thought when the question of nickel, cobalt, and iron came up. I wondered if the inhibiting effect there was in any way related to the fact that most of those metals are soluble in copper itself; and also, if that is the case, that the function of the iron is somewhat different from the nickel and the cobalt.

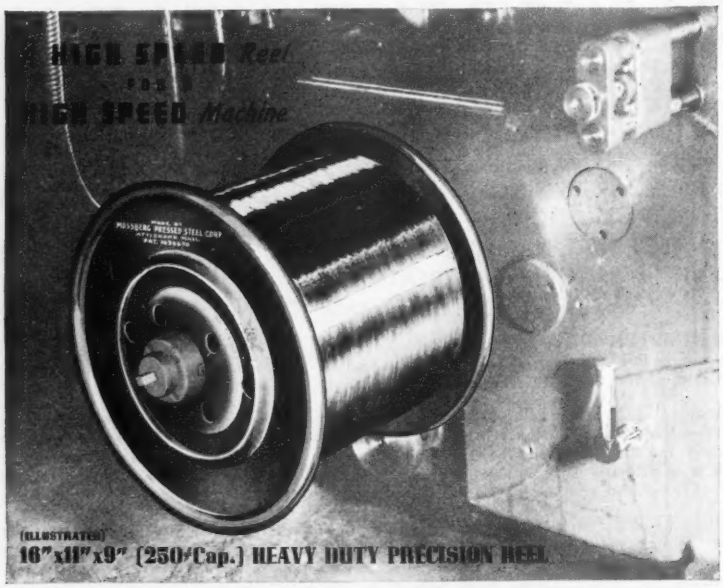
Mr. Donachie: Well, I was afraid somebody would ask that. Yes, nickel is completely soluble in copper. Cobalt is not so soluble in copper. It has a rather limited solubility, and so has iron, but in the presence of beryllium all form compounds.

Chairman Rolle: I think we owe a considerable amount of thanks to Mr. Donachie for this very excellent paper. I personally consider it one of the best we have had in the non-ferrous field.

I also want to thank the gentlemen who contributed to the discussion from the floor, and particularly those who took the trouble to send in written discussion.

If there is nothing further, the meeting is adjourned.

. . . The meeting recessed at four-fifteen o'clock p. m. . . .



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Herman Galvanizing Process by Rowland Hussey

(Continued from page 64)

Mr. Garrett: Yes.

Chairman Seymour: Any other questions?

Member: I would like to ask one question, Mr. Hussey. That is about the gas you are using for protecting purposes. How much do you use for a ton of wire galvanized?

Mr. Hussey: I don't know now. I haven't measured it. And it isn't enough to cause any worry from the standpoint of how much in actual gas you consume. It can't be very much, although there is quite a flame comes out of it. It is just a free-burning fire when it leaves the inside of the chamber.

Member: Very low pressure gas, isn't it?

Mr. Hussey: Yes.

Mr. Lewis: Have you used anything besides natural gas?

Mr. Hussey: Yes, we tried coke oven gas.

Mr. Lewis: With what luck?

Mr. Hussey: There were some bugs in it.

Mr. Lewis: Jack, you have had experience with some other gas, haven't you?

Chairman Seymour: Yes, I have had experience with all the gases.

Mr. Lewis: Go ahead. Give us the story.

Chairman Seymour: Coke oven gas will work and is working, if properly cleaned. Propane isn't good at all. It is too hot. It does the job and then the high flame melts the zinc up above the rig all over again. And city gas, apparently, if it is the water gas type, is not too good. Seems to make the zinc spotted instead of keeping it bright.

Mr. Lewis: I thought Joe Herman was running on city gas in Peoria.

Chairman Seymour: He might be, but there are different types of city gas, different ways of making gas for city gas. Producer gas probably would work all right.

Mr. Lewis: You don't mean soft coal producer gas?

Chairman Seymour: Yes.

Mr. Lewis: Clean?

Chairman Seymour: Yes.

Member: What is the life of the furnace as compared with the charcoal?

Mr. Hussey: Well, in years or tons?

Member: Both.

Mr. Hussey: 10,000 tons is about tops.

Member: How did it compare with the same tonnage and like sizes with charcoal?

Mr. Hussey: I don't think there would be any difference excepting you have a bigger tank. As I said before, you have a bigger tank and it is necessarily large to take care of the machine as it is set inside the main kettle. That is the only reason for more steel in the tank exposed to the action of the spelter bath.

Mr. Lewis: Can you say anything about the grades of zinc that can be used with satisfaction? Do they differ from the grades you would use with the same satisfaction in the other processing?

Mr. Hussey: I wouldn't recommend trying to sneak through with a lower grade.

Chairman Seymour: Any other questions?

Member: Is it possible to get a good wrap test on low carbon rim steel; say on .10 carbon?

Mr. Hussey: He is not looking at me, Jack. Bud Fisher wants to know if it is possible to get good wrap tests on low carbon rim steel, Herman galvanized?

Mr. Garrett: The answer is yes and no, on low carbon rim steel, no matter which way you galvanize it, Herman or charcoal type. Whether you get a good wrap depends upon how clean you get the rim steel base. Take low carbon rim steel, make sure it is clean, galvanize and you get a good wrap. If the base isn't clean, you won't get a good wrap, no matter how you put on the galvanize coating. We have come to that conclusion through a hell of a lot of trials and tribulations with trying to use low carbon steel. Where the wrap test is one of the primary requisites, it can be done with rim steel, but you have got to watch the cleaning and drawing of the wire.

Chairman Seymour: Any other questions? If not, I have a few announcements here I would like to make before you leave.

. . . The meeting was recessed at 3:42 P. M. . . .

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Oral Discussion of Measuring Wire Stiffness by Low Stress Elongation by C. B. Shopmyer

(Continued from page 76)

Mr. Shopmyer: That is right.

Chairman Davis: Was it your idea, Mr. Shopmyer, that such an instrument and such a method of test could be used universally in the industry by all people as a definite means of comparison?

We have numerous tests for the windability of magnet wire, and you are proposing that possibly this should be adopted universally so that different manufacturers and different buyers could correlate their own requirements. In other words, have one standard test so that when they order something to a definite specification for a definite job, the wire could be gauged and tested by this method. Is that your thought?

Mr. Shopmyer: Yes. The results are reproductive by different operators. I think that is rather important in any softness test. We have had considerable success with it because of this very fact. In other words, I haven't given figures which various wires in various stages should meet; that would be sticking my neck out. I would not expect all insulations to have the same LSE value. Film insulation of smaller sizes may require one and large rectangular wire may require a different treatment.

Member: Would you consider the test, if extended further, to be a possible index of the drawability of larger cross-sectional pieces?

Mr. Shopmyer: I think so.

Member: In other words, you would evaluate rods if your apparatus were sufficiently large.

Mr. Shopmyer: Yes, we have tested copper rods.

Member: Do you get an index of drawability?

Mr. Shopmyer: To a certain extent. It can be used, but usually the hardness of copper varies considerably near the ends.

Member: If you were to cut back sufficiently from the rod ends, say five or six feet, would that be satisfactory?

Mr. Shopmyer: Yes. We did test rods at one time for LSE and established a figure. Since then th erod we use has been well above that limit.

Chairman Davis: Mr. Shopmyer, this is a littl eoff the subject; I should like to ask whether this method of test has merely been integrated within your own operations or have you used it as a basis of specification for people who buy magnet wire for the windability; what is their reception to this test and how has it worked out in practice?

Mr. Shopmyer: We have used the LSE test since 1939. It has been a very helpful instrument in fabrication and in determining what various customers want or require in softness of rie of all sizes.

Chairman Davis: Then you use it within your plant for your own manufacturing operations to set up your own test for repetition of performance or orders rather than applying it to your customers and having them ask for this test on the particular order.

Mr. Shopmyer: That is right.

Mr. Rolle: Isn't it right, Mr. Shopmyer, that you do test the rods you get from various manufacturers to find out if they can be used for certain purposes?

Mr. Shopmyer: Yes.

Mr. Rolle: As I recall, that was the first application; is that not so?

Mr. Shopmyer: Yes.

Mr. Rolle: The use of the machine for the finer sizes was a subsequent development, because I remember having been told "Your copper is not suitable for this or that," and it was all due to the results obtained by this machine.

Mr. Shopmyer: We have several machines which take care of the entire range, from very fine wire to intermediate sizes of wire and rods.

Mr. Rolle: Some years ago I was told that its most important application was for the very fine sizes, especially for magnet wire. Is that so, or is it different now?

Mr. Shopmyer: Yes, that is right, but rectangular wire is also being tested to a very large extent in various winding operations. We have recently developed a very fine wire tester which has been giving very good results.

Member: You use this as a control test in the rectangular wire you sell?

Mr. Shopmyer: That is right. We have established definite figures for such wire.

Member: Do you know of anybody else that is using this beside yourselves?

Mr. Shopmyer: There are several others that have worked on it; practically all of our plants use it.

Member: I wonder if there is any correlation with the Scott tester?

Mr. Shopmyer: I am afraid I couldn't answer that; I haven't had too much experience with that tester.

Member: I haven't seen the paper, but it seems to me you would accomplish about the same thing. I wonder if there was a correlation there.

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Mr. Shopmyer: You are speaking of the Scott Tester?

Member: Yes.

Mr. Shopmyer: I am afraid I cannot answer that.

Chairman Davis: Mr. Shopmyer's machine, as I understand it, is merely a machine which will do your first calculation, which you won't get on the Scott tester. You can move this dial along until you hit the sectional area of your wire and read the result of the test directly. With the Scott Tensile Tester, in order to determine windability from the results obtained you still have to recalculate or make your calculation from the final determination rather than calculate your cross-sectional area first, which is about all you have to do by your machine. Right?

Mr. Rolle: If Mr. Shopmyer won't stick his neck out, perhaps he will permit me to do it for him. In the early days of this development which I watched with a great deal of interest, they found that results obtained with the Scott and other testers of which you speak were not suitable for the very fine sizes. As a matter of fact, it was because of the inconsistent results obtained with the Scott Tester that this machine was developed. The early designs were good for the latter models show a number of improvements.

Before the L. S. E. Tester had been developed they just threw up their hands when they got down to No. 40 and finer. The results obtained with the Scott Tester on wire made from rods rolled from the same lot of wirebars varied "all over the lot." So then they put their heads together and developed this machine.

I hope Mr. Shopmyer will forgive me for being presumptuous by telling you what went on at General Electric Company works; so if anybody becomes annoyed by this disclosure he can blame it on to me.

Mr. Shopmyer: Mr. Rolle correctly recalls the original difficulties; a great deal has gone over the dam since then.

Chairman Davis: This machine looks like a definite improvement and should save time and labor; as Ken Lewis would say if he were running a steel meeting. How many hours do you save by using it? It appears to provide a method for determining certain integrated operations within your plant and getting quick results and knowing where you can go further with that processed material or with the finished product. It also looks like a fine instrument for correlating customer's requirements, so you can repeat the performance and keep everybody satisfied. It looks like a nice move on the part of the Operating Department to keep the Sales Department out of trouble. It seems as though something like this should either be pulled apart because it will not work, if that is the idea in some people's minds, or it should be complimented and used more commonly. Are there any more questions?

Thanks a lot, Mr. Shopmyer, and thank you, gentlemen, for your discussion. [Applause].

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PLANTS AT CHICAGO, ILLINOIS AND GARRETT, INDIANA

Assisting Post War Trade

(Continued from page 83)

something better than existed in pre-war days and all should contribute a portion of the reconstruction costs without one section having to contribute the lion's share and another garner the lion's share of the profits.

✦ ✦ ✦

BUT another scheme must go hand in hand with anything on the lines of the above. There is no point in aiding export to countries where an inability to pay has been brought about by the incidence of war damage. Parts of Europe will have reached a stage of complete devastation—financial as well as physical. Whilst international arrangements will obviously again be made to assist the Governments of such countries, further facilities will be necessary to assist purchase by individual traders, manufacturers and operative undertakings. Ready to hand is the credit insurance policy which, in England has proved of such material benefit to exporters. Credit Insurance has a much longer history in the United States and there, as well as in the United Kingdom, requires continuous amendment to keep in step with changing conditions and the conditions which will obtain when Germany and Japan have finally been ousted from their state of belligerency.

✦ ✦ ✦

DEALING particularly with Europe where markets will be waiting, it will be readily understood that the pre-war three to four months credit period on purchases made from abroad will not suffice after the war except, perhaps, in the case of fully manufactured, day-to-day necessities. Wire cannot, in view of its ramifications, be included within such a heading. By no stretch of imagination can it be regarded as 'consumer's goods.'

✦ ✦ ✦

NO, where 3 to 4 months previously prevailed, 12 months is more likely to be demanded as necessary and when physical reconstruction plans commence to operate medium term credits will govern the acceptance or rejection of sales terms offered. Therefore, American manufacturers must be ready and willing to extend credit assistance of a nature never before experienced in commercial history.

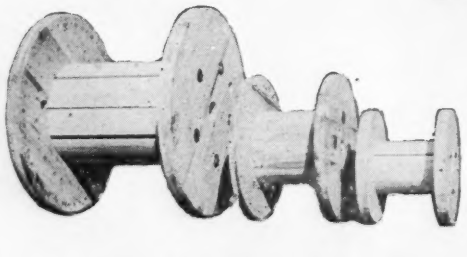
✦ ✦ ✦

SO far, so good, but how many undertakings, snowed under with orders, can accept such orders or an interesting share of them, finance the manufacture, shipment and delivery and still shoulder the burden of waiting for twelve months, or in some cases three and more years, for payment? The answer is 'very few' and of these, even a lesser proportion will be willing to do so without security. Yet again, the foreign purchasers can probably offer as security only bricks and rubble coupled with a great will to recover.

✦ ✦ ✦

THIS is where a Government supported Credit Insurance policy can step in. Risks of the type so briefly referred to are not for the Underwriting Company to place on its

WOODEN . . . REELS



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books. They are Government risks which should be accepted by the Government or by a Company on behalf of the Government provided they are given full re-insurance cover.

✦ ✦ ✦

BEFORE the war, the British Government offered contracts which provided a high proportion of cover against loss due to non-payment on account of war, invasion, internal upheaval, loss on exchange and loss due to fluctuation of shipping and freight rates. These various covers proved a boon to British Industry, manufacturers being able to purchase protection on deals which would otherwise have had to be refused. The burden of loss which would have crippled any underwriting syndicate, when spread over the community was but an infinitesimal load, mostly borne without knowledge or appreciation.

✦ ✦ ✦

COVERS such as these will be of the greatest practical advantage after the war when world reconstruction will depend more on good intentions and on good faith than on immediate financial ability to meet credit obligations on short or medium terms. Credit Insurance is available for the taking and no doubt steps are being taken in the U.S.A. to provide against post war credit eventualities.

✦ ✦ ✦

A SCHEME of financially assisted selling to hasten recovery will go a long way to benefitting the world, but a co-ordinated scheme of credit protection will ensure achievement of rehabilitation and set the seal on the peace time production standards for which we all yearn.

✦ ✦ ✦

The Foreman's Part In Veteran Rehiring

(Continued from page 84)

all veterans will come back, and that they are physically able to resume their former occupations.

✦ ✦ ✦

IN the case of the handicapped, supervisors can be of tremendous help in selecting or revising jobs which can be performed by such veterans. However much special counsel management secured in this direction, there is no substitute for the practical experience and enthusiastic support of the foreman on the job. He knows every wrinkle, every possible deviation from established routine. He should be sold on making extraordinary efforts to help out the amputee and the vet whose health has been undermined by the war.

✦ ✦ ✦

4. Displacing Civilian Workers:

IF the present employees fully realize that their jobs are temporary, and are subject to claim by returned veterans, there can be no serious ground for resentment when the issue finally arises. If seniority is the only basis for decision, as it is in some plants, every worker's seniority status should be clearly understood. If there is to be any question on such grounds, it is better to "have it out" via the regular grievance machinery **before** the veteran returns.

✦ ✦ ✦

SUPERVISORS should be placed on their guard against making any statements which might be interpreted by workers as assurance that the latter will be "protected" in their jobs. The clear-cut right of the veteran to reclaim his job should be understood by all who stand to lose out by his return.

✦ ✦ ✦

IN some instances, it will be found possible to avoid displacing workers. Vacancies left by resignations and discharges for cause may sometimes be left unfilled, or may be handled by persons temporarily transferred from other jobs or departments. Spread over a period of months, the normal mortality may leave ample openings for the returning servicemen. But even this "painless" course involves skillful planning by the foreman and his boss.

✦ ✦ ✦

5. Reinducting the Veteran:

THE first day back on the job is a Red Letter Day for the former warrior. He has been looking forward to it for months, even years. At the same time, he probably has

(Please turn to page 102)

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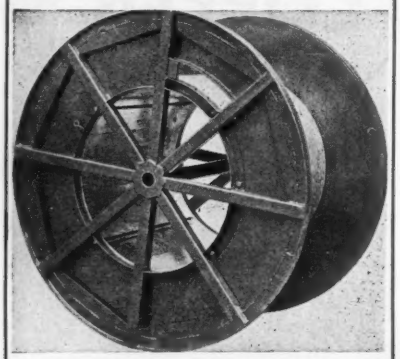

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Foreman's Part In Veteran Rehiring

(Continued from page 101)

worried about it, too — wondering if he can still "make the grade," worrying how he will "fit in."

✦ ✦ ✦

HERE is where the foreman can do valiant service, both to the company and the individual veteran. If the latter is to work again under his direction, the foreman should welcome him like the Prodigal Son, and personally introduce him to his new fellow workers, because most of them may be strangers. If the veteran's former supervisor has been transferred to some other department, he can still help out by escorting the returnee to the job assigned him, and by presenting him to the new supervisor in charge.

✦ ✦ ✦

EVERYTHING normally done for a new worker should be done for the returned veteran — plus all the trimmings of kindliness and consideration and remembrance that can be added.

✦ ✦ ✦

6. Weathering the Readjustment Period:

MUCH of the "problem child" copy that has been written about returning veterans was based on limited experience — largely with men who were discharged for medical reasons. Without idealizing the veterans who are now returning to civilian life, it is a good start to concede that the great majority of them are healthier, stronger, more amenable to discipline and better trained to resume civilian responsibilities than were their counterparts after World War I.

✦ ✦ ✦

OF course it is hard to settle down to a machine or a truck after handling machine guns and tanks. There is boredom in a job, just as their was in the camp or the distant island base. There are hard-to-bear domestic responsibilities, just as there were hard-to-bear relationships in barracks or in close quarters afloat. And there may be a sprinkling of special cases for every plant to handle — but it is better to single them out for special treatment than to take the opposite extreme and regard all veterans as "queer."

✦ ✦ ✦

THE foreman who managed to get through the war with marginal labor — nursing this one, encouraging that one, being a father to the youngest and a son to the over-age — will have little or no trouble with veterans. Reemploying them is a human relations assignment. That's why supervisors are the logical men to see the job to completion.

✦ ✦ ✦

W. A. Technical Discussions Oral Discussions of Trembicki Paper

(Continued from page 69)

buys that wire is accustomed to a certain finish, and even goes so far as to specify a certain finish. Some of them even want a sull coat and lime on it. So when that part of the trade gets educated to a different look of that finish, we will draw that wire, too, without lime.

Chairman Lewis: This discussion, I know, will go on and on in the corridors and in the hotel bedrooms and eating places far into the night. I think perhaps I had better look around here and call on three or four people whose opinion, I think, is likely to represent a considered judgment and who have had experience in some degree with one or more of these new coating compounds, and just ask for a snap opinion.

Do you think that this line of products has any definite future? Do you think it is going to come fast and far? Mr. Lewis, of Roebling, I think you have come in contact with this.

Mr. D. Lewis (John A. Roebling's Sons Co., Trenton, N. J.): I don't know that I am qualified to do that because Mr. Seymour is here. I will say that we are using these compounds with quite a little success. We are not using them 100 per cent. We still use lime. We have to use lime for certain jobs because of the difficulties we run into in trying to use the compound.

However, where we do use the compound, we are getting better die life and we are satisfied. We certainly intend to continue our investigation of the compound, and hope that it increases our production.

Chairman Lewis: I have a notion I ought to have die man here to say something because the die is where troubles accumulate. From what I have heard, I don't believe it is necessary because none of you fellows would take any interest in this stuff; you are all die-conscious; none of you would take any interest in this stuff if it didn't do the die some good.

Wire Association Attendance List, Chicago, Illinois

(Continued from page 82)

VERSCHLEISER, J. H., Sales Mgr. Wire,
Laclede Steel Co.,
Arcade Building,
St. Louis 1, Mo.

VICK, ARTHUR, Die Dept.,
Reynolds Wire Co.,
Dixon, Ill.

VOIGTLANDER, CURTIS, Supt. Wire Mill,
Union Wire Rope Company,
21st & Manchester Streets,
Kansas City 3, Mo.

WAARICH, O. W., Gen. Supt.,
Pheoll Manufacturing Co.,
5700 Roosevelt Road,
Chicago 50, Ill.

WAGNER, R. J., Met.
Gary Screw & Bolt Company,
Gary, Ind.

WARD, C. T., Supt. Rod & Wire Mills,
Bethlehem Steel Company,
97 Third Ave.,
Johnstown, Pa.

WARDLE, A. J., JR., Sales Engr.,
McKay Machine Co.,
Youngstown, Ohio

WATERS, H. W., Asst. Supt.,
Steel Co. of Canada,
Canada Works,
Hamilton, Ont., Canada

WEBER, ELMER C., Die Designer,
Service Engr.,
Firth Sterling Steel Co.,
McKeesport, Pa.

WEIKEL, GEO. A., Rep.,
American Chemical Paint Co.,
Evanston, Ill.

WEINMANN, E. R., Sales Manager,
Nukem Products Corp.,
55 West 42nd Street,
New York 18, N. Y.

WEISE, FRANK E., JR.,
Bethlehem Steel Company,
Williamsport, Pa.

WEISS, J. G., Gen. Foreman,
Keystone Steel & Wire Co.,
Peoria, Ill.

WERNER, JOHN H., Sales Engr.,
Lee Wilson Eng. Co., Inc.,
20005 W. Lake,
Cleveland, Ohio

WIDERBERG, HERBERT, Sales Engr.,
F. B. Shuster Co.,
New Haven, Conn.

WHITTER, J. L., Sales Mgr.,
Lee Wilson Eng. Co.,
20005 W. Lake,
Cleveland, Ohio

WIELQUILLARDET, L. D., Consultant,
42 Broadway, Room 1530,
New York, N. Y.

WILLIAMS, J. E., Plant Mgr.,
Nichols Wire & Steel Co.,
1021 Raymond Road,
Battle Creek, Mich.

WOLF, Richard, Chf. Field Engr.,
The Watson Machine Co.,
Paterson, N. J.

WOOD, LAWRENCE, Mech.,
Spencer Wire Co.,
West Brookfield, Mass.

WRAY, HERBERT,
Luginbill Wire Die Co.,
Ft. Wayne, Ind.

ZAPP, A. R.,
Firth Sterling Steel Co.,
McKeesport, Pa.

ZUCKER, LEONARD A., Manager,
The Union Wire Die Corp.,
Stamford, Conn.

BULLOCK, FRANK W., Colonel, U.S.A.,
540 O'Sullivan Building,
Baltimore, Md.,

HAMAKER, L. S., Asst. Gen. Mgr. of Sales,
Republic Steel Corp.,
Republic Bldg.,
Cleveland, Ohio

RANSOHOFF, N., Pres.,
TheRansohoff Company,
Cincinnati, Ohio

SPENGEL, R. S., Secy.-Treas.,
WIRE AND WIRE PRODUCTS,
300 Main Street,
Stamford, Conn.

BROWN, R. E., Pres.,
WIRE AND WIRE PRODUCTS,
300 Main Street,
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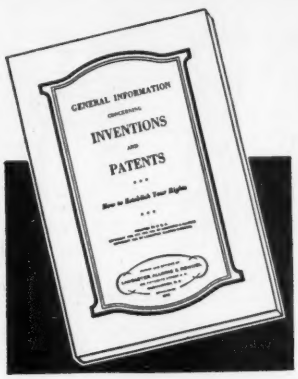

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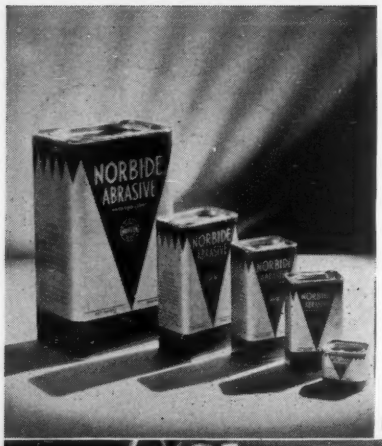

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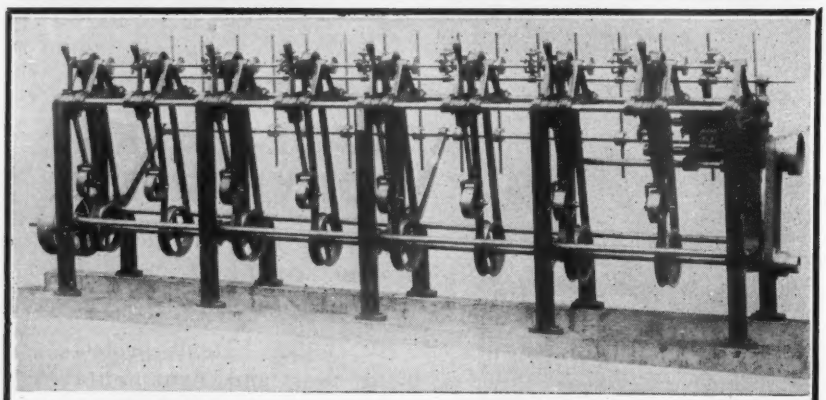

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DuPont Initiates New Research Studies

PLANS to investigate organic syntheses involving nitration, nitrolysis, nitric acid esterification, and nitric acid oxidation to provide new and useful compounds for industry are announced by **E. I. du Pont de Nemours & Co., Inc.** A program for large-scale semi-works production of new organic derivatives already is under way in the Explosives Department.

✦ ✦ ✦

THE compounds include the new cyclohexane derivatives—epsilon-caprolactam, cyclohexanone oxime, and nitrocyclohexane.

✦ ✦ ✦

DU PONT said the lactam and the oxime can be supplied in quantities ranging from pound lots for laboratory and semi-commercial scale work to ton lots for industrial applications for use in textile processing, the pharmaceutical industry, or in the manufacture of corrosion inhibitors, insecticides, etc.

✦ ✦ ✦

POUND samples of nitrocyclophexane are available for experimental use in the manufacture of rubber chemicals, resins, solvents, dyes, pharmaceuticals, lacquers, and emulsions. Among its possibilities is use as an industrial solvent in the dewaxing of lubricants and the extractive distillation of petroleum.

✦ ✦ ✦

EPSILON-caprolactam is available either as a solid or as a 67-76 per cent aqueous solution. The vinyl derivative of this chemical is said to have value as a textile assistant, plasticizer, etc. Caprolactam can be chlorinated, sulfonated, methylated, etc., to produce new and interesting derivatives.

✦ ✦ ✦

NITROCYCLOHEXANE is available at the present time in lots up to five gallons for experimental purposes. It undergoes the reactions typical of the nitroparaffins and thus opens up a path to a wide variety of new organic compounds, including nitro and amino alcohols, acids, and esters. It can be hydrogenated at moderate temperature and pressure

to form cyclohexylamine which may be used as an intermediate in the production of corrosion inhibitors, insecticides, solvents, plasticizers, etc.

✦ ✦ ✦

THE Du Pont Company said the Explosives Department, with adequate semi-works facilities and a broad background in the evaluation of processes employing nitric acid, would welcome requests for the manufacture of any new compounds which may fall within the scope of this program.

✦ ✦ ✦

American Steel and Wire Preparing for Increased Production at Waukegan

AN expenditure of over $1,000,000 for improving, rearranging and increasing the production of stainless steel wire at the Waukegan, Ill., Works of **American Steel & Wire Co.**, U. S. Steel subsidiary, has been announced by John Gaut, general superintendent of the plant. The new project will start immediately and will put the Waukegan Works in the forefront among producers of stainless steel round wire in the country.

✦ ✦ ✦

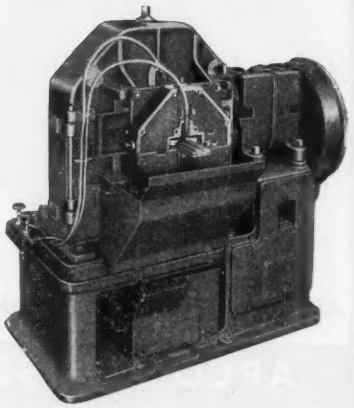
A NEW modern-type, single story building will be constructed to house the facilities. The structure will have approximately 100,000 square feet of floor space and will be a completely integrated unit, drawing and processing from hot rolled rod to the finished product. Wire ranging from ½" to .004" in diameter in rounds and shapes will be produced in the new unit.

✦ ✦ ✦

PROVISION will be made for rod storage, heat treating, cleaning, wire drawing and finishing operations, such as grinding, polishing, straightening and cutting, spooling and packaging. It is estimated that construction will take about 12 months, which would mean the plant will be in operation early in 1947.

All four sides are rolled simultaneously by "Standard" Turks Heads (adjustable draw plate) — the metal trade's established method of drawing rod to triangular, rectangular and special shapes such as keystone, diamond, star and channel forms — both plain and ornamental.

"Standard" Turks Heads, universal and plain types, are available in a wide range of capacities.



WRITE FOR CATALOG T. H.

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ROOS

WIRE DRAWING DIE MACHINERY

Has proven itself by the performance of precision and quality work in almost every steel, aluminum and copper mill in the U.S.A.

LAPPING MACHINES • DIAMOND LATHES • POLISHERS

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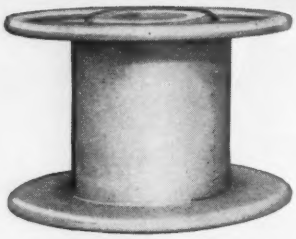
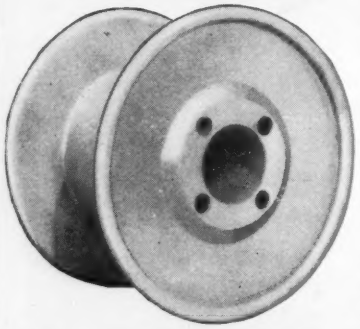
H&G ROOS TOOL & MFG. CO. — **17-19 GROVE ST., MONTCLAIR, N. J.**

FOR HIGHEST SPEEDS



APCO MOSSBERG
PRECISION
STEEL REELS

The reels that are engineered to the job... designed and built by the company that originated the steel reel idea . . . are the reels you should be using in your plant. Every year, more and more Apco Mossberg Steel Reels are bought by quality-minded buyers throughout the wire industry.



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Without obligation to you, Apco Mossberg engineers will be glad to study your reel problem, and supply complete suggestions, drawings, blue prints. Write for information today.

REELS . . . SPOOLS . . . BOBBINS

APCO MOSSBERG COMPANY
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MORE PRODUCTION
IN LESS TIME *with*
CARL-MAYER
FURNACES, OVENS

CARL-MAYER HI-SPEED
ROD BAKER

The fastest rod baker built! Saves up to 50% in time and fuel. Patented Blow-Off Feature removes moisture without bumping or agitating the coils. **Patented and patents pending.**

WELDING ROD OVEN

For drying coated welding rods. Uses the "Mayer" Recirculating Gas Fired Air Heater principle and Rod Transfer Systems (patents pending).

Growing interest in our type of equipment is evidenced by Carl-Mayer installations in such plants as:—

Atlantic Wire Co.
Atlas Tack Corp.
Atlas Steel Co.
Eaton Mfg. Co.
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Johnson & Nephew Ltd.
Page Steel & Wire Co.
Pittsburgh Tool Steel Wire Co.
Steel Co. of Canada
Wickwire Spencer Steel Co.

WRITE for BULLETIN No. 211

THE CARL-MAYER CORPORATION 3030 EUCLID AVENUE CLEVELAND, OHIO

Phillips Chemical Co. Announces New Emulsion Cleaner, "PSC"

Phillips Chemical Co. announces their new emulsion type cleaner, PSC, for use in power spray washers. PSC cleans ferrous and non-ferrous metals and inhibits them against rust, corrosion and hand soil. It is non-toxic and non-injurious to the skin or open cuts; requires no rinsing and will keep the washing tank clean.

✦ ✦ ✦

PSC is extremely economical in use and can be diluted with water in proportions of from 1-10 to 1-100, depending upon the type and amount of soil and the length of time rust resistance is desired. It is necessary only to wash the parts and blow them dry with air for complete cleaning and rust inhibition. PSC removes grease, oil, wax, lapping and drawing compounds of all kinds, red lead and other markings, abrasive dust, chips and filings from the surface as well as from ID and OD recesses.

✦ ✦ ✦

THE cleaning action is accomplished by means of its penetrating properties and its "blanket overflow" action. PSC penetrates to the surface of the metal, breaking soil into tiny particles which rise to the top of the solution in the tank and are held in the PSC "blanket" while heavy solid particles sink to the bottom of the tank. The "blanket" may be periodically overflowed, keeping the bulk of the solution in the tank clean and avoiding the washing of other parts with soiled cleaner. In addition there is less strain on the pumps and much less possibility of clogged spray nozzles.

✦ ✦ ✦

DEPENDING upon the type of PSC used and the degree of dilution all metal parts are inhibited against rusting, corroding and hand soil long enough for inspection or storage, up to several weeks, yet finish is clean and suitable for painting or other finishing. PSC is available in three types: #1 for light duty, #2 for heavy duty and #3 for special rust-resistant qualities.

COMPLETE details and prices are available on request to the **Phillips Chemical Products Co.**, 3411 W. Touhy Ave., Chicago 45, Illinois.

✦ ✦ ✦

Industrial Diamonds No Longer Controlled

INDUSTRIAL diamonds have been freed from federal distribution controls, the Civilian Production Administration announced in December.

✦ ✦ ✦

THIS relaxation has been effected in this country through the revocation of Order M1-09. Industrial diamonds in various forms are used principally as tools to realign cutting and grinding tools.

✦ ✦ ✦

RESTRICTIONS on importation of diamonds in the import order, M.63, are expected to be eliminated shortly. However, overall domestic inventory controls in Priorities Regulation 32 are still applicable.

✦ ✦ ✦

THE revocation met with the majority approval of the Industrial Diamond Industry Advisory Committee at its recent meeting. Although industry members declared that the removal of the controls might cause some market dislocations, it would be no more than the inevitable market disturbances whenever controls are removed.

✦ ✦ ✦

THE December diamond quotas from Great Britain, our principal source of supply, have already been arranged, the Civilian Production Administration said. Accordingly, the termination of this order at this time will in no way effect the immediate supply situation, they said.

✦ ✦ ✦

INSOFAR as overall supply is concerned, adequate industry stocks and imports are available for anticipated requirements, the Civilian Production Administration disclosed.

TUNGSTEN CARBIDE DIES
for HEADING and
WIRE AND TUBE DRAWING (.030" to 2"), EXTRUSION (1/16" to 1"), RECUTTING AND WELDING ELECTRODE COATING.

RING GAUGES
DIAMOND DIES (.0015" up)
DIAMOND POWDER IN ALL GRADES

AIRCRAFT EXTRUSION DIES

As a special service to customers, we are prepared to give three day service on standard wire, tube and extrusion dies in cases of extreme urgency.

Address Inquiries to

MICHIGAN WIRE DIE CO.
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NILSON AUTOMATIC PRESS and FOUR SLIDE MACHINE

FOR SWAGING, STAMPING, PIERCING, BLANKING, FORMING OF COILED METAL

WE also build machines for forming Paper Clips, Buckles, Gate Hooks, Coat and Hat Hooks, Ceiling Hooks, Wire Ears, Cable Rings, Screw Eyes, Sash Chains, Automobile Side Chains, Flat Open Link Chains, Staples, Cotter Pins, Hose Clamps, Etc., and Wire Straighteners, Wire Reels, Frame Bending Machines and Special Presses.

For Complete Details Address—

THE A. H. NILSON MACHINE CO.
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WIRE CUTTING
MADE EASY

Hard wire*, spring wire, as well as soft wire, wire fabric, tie wire, fencing, etc. — easily and quickly cut with a porter tool. A standard model for average needs. Special models for special work.

Send for catalog showing all Porter models of wire cutters, bolt clippers, etc.

*(with center cut round edge jaws)

H. K. PORTER, INC.
EVERETT 49, MASS., U.S.A.

PORTER HKP CUTTERS

ACID AND ALKALI PROOF
LININGS AND MORTARS

●

ACID PROOF
CONSTRUCTION

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THE CEILCOTE CO.

Consulting and Research Engineers

750 ROCKEFELLER BLDG.
CLEVELAND, OHIO

Heavy Duty Kathabar Unit For Industrial Air Conditioning

IN addition to present units, a vertical contractor of heavy duty construction is offered in the new Kathabar unit now being announced by **Surface Combustion Corporation,** Toledo 1, Ohio. This unit has been developed especially for larger industrial applications where close control of humidity is necessary to maintain product quality and to insure continuous production.

✦ ✦ ✦

KATHABAR systems provide a reliable means of dehumidifying-humidifying the air independently of temperature for processing operations and for personal comfort. Due to its high efficiency, it is especially useful where low dew point air is required. Because of the mechanical simplicity of the unit and accuracy of control of air moisture this unit is the choice of industrial air conditioning engineers who must maintain an ideal atmospheric condition.

✦ ✦ ✦

UNITS are already in operation in many industries requiring "controlled humidity" atmospheres in quantities from 10,000 c.f.m. to 70,000 c.f.m. Smaller package unjts from 1350 c.f.m. to 5000 c.f.m. and large central systems are also available.

✦ ✦ ✦

SOME of these Kathabar processing operations provide conditioned air as low as 19° dew point, or about 6 per cent relative humidity at 90° F. Kathabar units have been tested at dew points as low as 80° below zero.

✦ ✦ ✦

KATHABAR Systems utilize an inherently continuous regenerative process, thereby eliminating cyclic operation common with drying agents. Thus, constant 365-day operation is practical.

✦ ✦ ✦

Optimus Introduces New Rapid Solvent Cleaner

THE **Optimus Detergents Co.,** 250 Church Street, Matawan, N. J., manufacturers of industrial metal

Longer Runs More Tons With Oakite CrysCoat

By imparting a fine grain crystalline phosphate coating to surfaces of ferrous rods and wire, the newly-developed Oakite CrysCoat process provides these four important advantages: (1) longer die life, because of the tenacious parting layer between metal and die to act as an added lubricant; (2) increased production; (3) shorter downtime of equipment; (4) uniform appearance of wire.

Write for FREE Service Report describing method of using . . . containing useful technical data on Oakite CrysCoat Process. If you wish, demonstrations will gladly be arranged at your convenience.

OAKITE PRODUCTS, INC.
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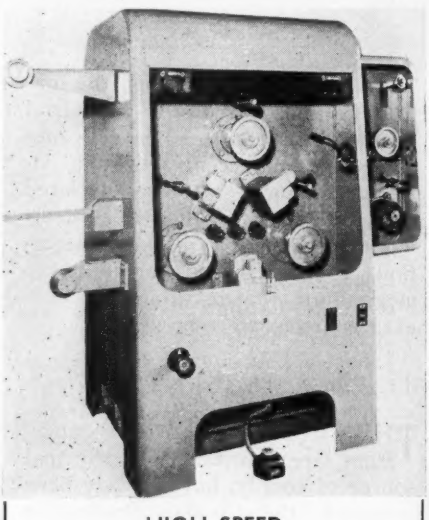
Technical Service Representatives Located in All Principal Cities of the United States and Canada

OAKITE *Specialized* CLEANING
MATERIALS • METHODS • SERVICE



HIGH SPEED
WIRE DRAWING MACHINE
for Intermediate and Fine Wire

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"American" INSULATING MACHINERY COMPANY

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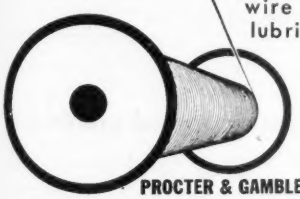
FOR MAXIMUM "MILEAGE" AND FINISH CONTROL IN YOUR WIRE DRAWING OPERATIONS USE P&G SOAPS

For drawing both ferrous and alloy wires—in either dry or wet operations — you can depend upon these important qualities in Procter & Gamble soaps:

Excellent Adherence
Efficient Lubrication
Minimum Dusting
Uniformity
Economy

One of our representatives will be glad to discuss wire drawing lubricants with you.



PROCTER & GAMBLE, CINCINNATI

cleaners, has introduced a new solvent cleaner, Optimus Solvent No. 2. The product is quick and effective in removing grease, oil, carbon, grit and miscellaneous shop dirt from metal parts.

✦ ✦ ✦

ORIGINALLY developed for cleaning of parts to facilitate inspection, this new material is finding wide usage in other industrial cleaning operations. Proper solvent blending in the making of this new product provides more versatility in the selective attacking of greases and dirts to be removed. Completely miscible, this product will combine in kerosene or other hydro-carbon diluent, and remove soil from work by solvent cleaning action. A water rinse emulsifies the solvent and kerosene mixtures readily rendering physically clean surfaces suitable for further processing. Properly diluted with water, it is also applicable as a pre-soak prior to electro-cleaning to removetripoli, rouge and similar buffing compounds.

Tensile Testing Bulletin Just Issued By Dillon

MANUFACTURERS small as well as large will find important news in a new and comprehensive illustrated Bulletin just issued by **W. C. Dillon & Co., Inc.,** 5410 W. Harrison St., Chicago 44, Illinois. The Bulletin goes into considerable detail on testing tensile, compression, transverse and shear, for the widest range of materials and all shapes of specimens. Supplementing the Bulletin, free specimen charts compiled by Dillon engineers are offered on request.

✦ ✦ ✦

OF particular interest is the statement that every concern can now afford precision physical testing in its own shops, eliminating outside service charges. The Dillon unit insures the utmost accuracy, with the advantage that it is easily operated even by the untrained. It is calibrated by Morehouse Ring, certified by U. S. Bureau of Standards. The tester comes in seven capacities: 0-250, 0-500, 0-1,000, 0-2,500, 0-5,000, 0-7,500, and 0-10,000 Lbs. All units are the same size and weight, with interchangeable capacities, Overall height (without floor stand) 37", net weight 132 lbs. Type of drive, worm-geared from hand wheel to loading screw. The tester can be motorized, if desired.

✦ ✦ ✦

Morse Chain Appoints New Works Manager at Ithaca Plant

Frank C. Tippery was named works manager of the Ithaca plant of **Morse Chain Co., division of Borg-Warner Corp.** Mr. Tippery comes to Morse Chain from the Ford Motor Co.

Warner

BELL-MINE LIME

for

WIRE DRAWING

Warner COMPANY

BELLEFONTE DIVISION
BELLEFONTE, PA.
Sales Offices
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TO WIRE MILL MEN

Have you considered joining the Wire Association? You are cordially invited to become a member. Dues are $10.00 a year, which includes a subscription to WIRE & WIRE PRODUCTS and a copy of the Annual Buyers Guide.

THE WIRE ASSOCIATION
300 MAIN ST. STAMFORD, CONN.

Waterproof and Crepe Paper

In rolls of any size for wrapping coils and reels

Crepe-Kraft Barrel Liners

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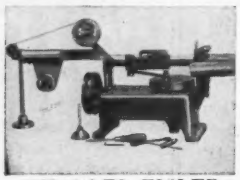
WIRE CUTTING and SHAPING MACHINES, FINE WIRE WELDERS

We make Spot Welders from ¼ to 500 KVA & all Types Butt Welders

Automatic Drawing and Cutting Mach.

Eisler fine wire cutting and forming machines have been in use over twenty-five years.

Wire Cutting & Annealing Mach.



Bench Type Butt Welder

Spot Welder

CHARLES EISLER

EISLER ENGINEERING CO., 747 So. 13th St., near Avon Ave., **Newark 3, N.J.**

NIAGARA Aero HEAT EXCHANGER

Saves cooling water costs, saves equipment, saves power. Controls temperature of Wire Drawing Compounds, Industrial Liquids, Quenching Baths, Jacket Water, Lubricating Oils.

Write for Bulletins 90 & 94

NIAGARA BLOWER COMPANY

General Sales Office: 6 E. 45th St., New York 17, N. Y.
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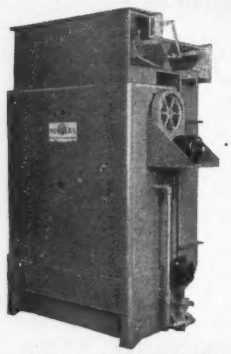
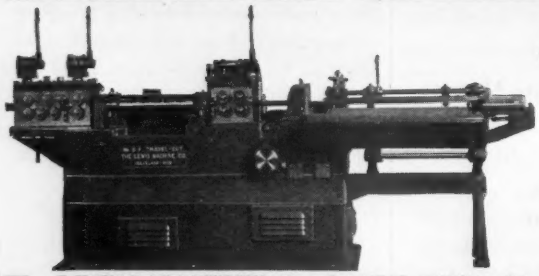
SALES ENGINEERS IN PRINCIPAL CITIES



U. S. Patent Nos. 2,296,946, 2,321,933 & Re-issue No. 22,553.

LEWIS TRAVEL-CUT WIRE STRAIGHTENING and CUTTING Machines



Machines for 1/16" to ¾" rod
Round
Square
Flat
Hexagon
Ferrous and Non-Ferrous

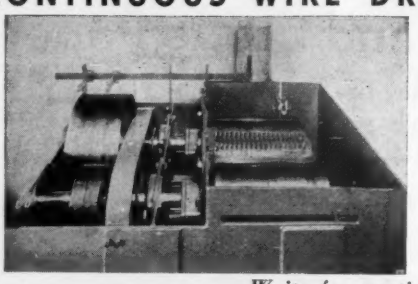
Automatic
High Speed
Heavy Duty

The Sign of Dependable Service:

WE CAN SUPPLY AND ENGINEER OUR TOOLS EQUIPPED WITH CARBOLOY CEMENTED CARBIDE

The LEWIS MACHINE Co., 3445 E. 76 St., Cleveland, O.

CONTINUOUS WIRE DRAWING MACHINE



for low carbon, high carbon and alloy wires, with provision for twenty drafts. Spooling attachment furnished if desired.

Also makers of other wire drawing machines, wire mill accessories, such as spoolers, straighteners, pointers and water cooled die holders, and special machinery.

Write for particulars

SUPERIOR TOOL AND MANUFACTURING CO.

172 UNION STREET • WORCESTER, MASS.

American Steel & Wire Makes Personnel Changes In Operating Staff

APPOINTMENTS affecting three operating executives at the Trenton, N. J., and New Haven, Conn., plants are announced by American Steel & Wire Co., U. S. Steel subsidiary.

✦ ✦ ✦

Stephen B. **Metcalfe** has been named special engineer in charge of rope plant development and will be located in the chief engineer's office in Cleveland, Ohio. **A. J. King** has been appointed general superintendent of the New Haven and Trenton Works and will center his activities at New Haven. At the same time, **Charles R. Chase** has been made superintendent of the Trenton Works, succeeding Mr. King.

✦ ✦ ✦

Fine Wires of Special Materials

A NEW 8-page booklet titled "Fine Wire of Special Materials" has been announced by North American Philips Company, Inc., 100 East 42nd Street, New York.

✦ ✦ ✦

THE text material was written by **Robert L. Zahour,** Technical-Commercial Manager of the Company's Wire Division, and brings the reader up to date on manufacturing methods and problems connected with wires 0.002″ to 0.0007″ diameters and smaller.

✦ ✦ ✦

AMONG the subjects treated are:

1. Important steps in producing a good diamond die.
2. Drawing the wire.
3. Methods for checking diameter, elongation, tensile strength and ohmic resistance.
4. X-ray diffraction examination of atomic structure.

✦ ✦ ✦

THE booklet contains ten photos which make the text easy to understand.

New Book On Glycerine

THE **Chemical Publishing Company,** Brooklyn, 2, N. Y., has brought out a 302-page book selling for $5.00, entitled "Glycerine, Its Industrial and Commercial Applications".

✦ ✦ ✦

STARTING with the history of glycerine, there are twenty-eight chapters, each devoted to a different industry, as Lubricants, Metals, Plastics, Protective Coatings and Rubber. A final chapter contains an appendix, tables and an index. The book is a comprehensive survey of a large number of industrial products which contain glycerine and shows how glycerine may be used in them or other products. A wealth of formulae have been selected by the authors, Georgia Leffingwell, Ph.D., and M. A. Lesser, B. Sc., as those most used in standard applications. The treatise is written in a clear and simple style, that will make it useful to the individual worker as well as valuable to the chemist and manufacturer.

✦ ✦ ✦

Wickwire Spencer Appoints Rollo New England District Manager

THE Wickwire Spencer Steel Division, Colorado Fuel and Iron Corporation, announced today the appointment of **Herbert D. Rollo** as New England District Sales Manager.

✦ ✦ ✦

MR. Rollo has been connected with Wickwire Spencer since 1933. He has been stationed in Chicago and in New York as Wire Rope Sales Engineer. Prior to 1933 he was with the American Chain and Cable Co. in the Engineering Department.

✦ ✦ ✦

IN his new position Mr. Rollo will have full charge of all sales operations throughout New England. Currently Wickwire Spencer is expanding its sales activities and developing new and wider postwar markets throughout this area in which several of the company's plants and fabricating mills are located.

✦ ✦ ✦

MR. Rollo will make his headquarters at 80 Federal Street, Boston 10, Massachusetts.

California Wire Cloth To Direct CF&I Pacific Coast Sales

THE **California Wire Cloth Corporation,** West Coast subsidiary of the Colorado Fuel and Iron Corporation, will manage sales and service operations of CF&I on the Pacific Coast, it has been announced by **E. P. Holder,** President of CF&I, serving Washington, Oregon, California and Nevada.

✦ ✦ ✦

CALIFORNIA Wire Cloth thus will direct the sales of all products of the following companies: The Colorado Fuel and Iron Corporation, Wickwire Spencer Steel Division, Wickwire Spencer Metallurgical Corporation, Coburn Trolley Track Division, and American Wire Fabrics Corporation.

DIAMOND-CARBIDE
WIRE - SHAPE - TUBING
EXTRUSION - HEADING
DIES
ALSO TOOL & WEAR RESISTING PARTS
UNITED DIE CO.
46 W. KINNEY ST., NEWARK, N.J.

DIAMOND DIES .0006 - .120 DIAMOND POWDER
INDUSTRIAL AJAX SUPPLIES INC.
R.R. 4, P.O. Box 66, Ft. Wayne 1, Ind., Tel. H-1311

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DIAMOND DIES, DIAMOND POWDERS
Eastern Representative of
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DIAMOND DIES
.000's to .102
Fort Wayne Wire Die Co.
2625 E. Pontiac St. Fort Wayne, Ind.

DIAMOND AND CARBIDE WIRE DRAWING DIES
RUSCH WIRE DIE CORPORATION
Croton-on-Hudson, N. Y.

DIAMOND DIES for WIRE DRAWING
Better Dies for Better Wire
WWD.CO. 057
WAYNE DIES have been called by users "The best dies obtainable." That is because they are made by men who have spent years in turning out dies that are precision made for wire mills whose products are made to the highest standards of accuracy and finish. Look for the stamp "WWD" if you want the best.
WAYNE WIRE DIE CO. 200 PENNSYLVANIA AVE., HILLSIDE, N. J.
Telephone: Elizabeth 2-2456

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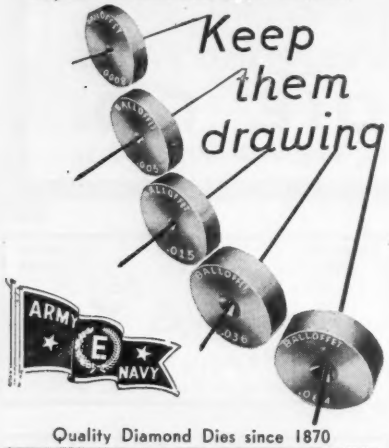
DIAMOND DIES
Large stock on hand of domestic and imported dies available for immediate shipment in sizes from .0004" to .081".


Quality Diamond Dies since 1870
BALLOFFET
DIES AND NOZZLE CO., INC.
68-25 Adams at 68th Street
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WILLEY'S
DIES—MADE OF
WILLEY'S METAL

Provide exceptional abrasion resistance. Standard one-piece round dies from stock. Special dies to meet your requirements. Production costs go down when you specify Willey's Metal.
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WILLEY'S
CARBIDE TOOL CO.
MANUFACTURERS AND SPECIALISTS IN
TUNGSTEN CARBIDE TOOLS
1340 W. VERNOR HIGHWAY • DETROIT, MICHIGAN

Boundaries

(Continued from page 36)

of the Elbe, there will be firm consolidation along this line which will be held, if only in trust, until those fertile lands between the Elbe and Rhine and all the wealth that lies there will be used constructively for the arts of peace, and no longer for war.

✦ ✦ ✦

THERE is also the hope that the German population in this area through the beneficent and practical application of our democratic laws and customs may be educated and directed for years until the youth of that land have their minds moulded to our democratic ways.

✦ ✦ ✦

SO much for history; now for ourselves and the future of our Wire Association. Not to make too much play on a word, but everyone has an Elbe boundary in his life and not only related to individuals but to every form of business.

✦ ✦ ✦

EVERY organization with expansive, progressive ideas is faced with the problem of new frontiers —properly defended, and we are right back to Eric Johnston's "Challenge for new frontiers for modern Economic Audacity and Development."

✦ ✦ ✦

WITHIN the bounds of our Wire Association cordial friendship and common interest has been developed through years of struggle when this Association did not hold the same place in general esteem as it does now.

✦ ✦ ✦

ANY self-satisfaction on our part that our excellent membership in itself assures our position will be the beginning of the end of our progress and the value of this association to the wire industry.

✦ ✦ ✦

AS the Roman legions gave ground, dropping back from the Elbe to the Rhine, having lost that vital quality of determination and zeal to

NOW IN STOCK
French Diamond Dies
IN CAPILLARY SIZES
made by
Etablissements Jos. Vianney
Trevoux, France
Famous Wire Drawing Diamond Dies

.0004	.001
.00045	.0011
.0005	.0012
.00055	.0013
.0006	.0014
.00065	.0015
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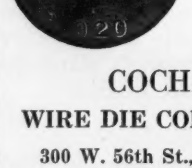
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maintain the boundaries which they knew were vital to their life and success, so may our Association lose its position if our members as individuals and collectively do not continue to put themselves enthusiastically into the efforts for which the Association was formed, namely, to assure a medium of friendly intercourse and exchange of technical information advantageous to the wire industry.

✦ ✦ ✦

BY that we will move the outward boundaries of technical knowledge and assist in stabilizing the wire industry in its proper place in the economic structure of the nation.

✦ ✦ ✦

THE establishing of boundaries is one thing—the stabilizing of such boundaries is much more difficult and in the important years ahead, fraught with many elements to discourage and distract, I am sure the quality of the Wire Association membership will fully assert itself to assure our share of progress as the future unfolds.

✦ ✦ ✦

Postlude

I HOPE I am not creating an anti-climax when I express a few thoughts informally to the members of this Association.

✦ ✦ ✦

OF the original five who formed the first group, out of which our organization developed, three of them—**John Mordica, William Pearson** and **George Hartley**—have passed on. The remaining two originals, **Kenneth Lewis** and **Richard E. Brown,** are with us and still very active.

✦ ✦ ✦

OUR membership is now over 600, and our Association has received world-wide recognition as a technical and research society. We have extended our boundaries far beyond the dreams of the original five.

✦ ✦ ✦

TO maintain our standing, new thoughts and new methods must be constantly introduced and encouraged. Younger men and the newer

(Please turn to page 114)

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Boundaries

(Continued from page 113)

members must, in the natural course of events, gradually take over the development and control of this Association.

✦ ✦ ✦

THE future success of your Association will be a function of what you give it in the present. In conclusion, I quote the poet Tennyson, who so aptly puts the following words in the mouth of his hero "Ulysses":

"I am a part of all that I have met;
Yet all experience is an arch wherethru'
Gleams that untravelled world whose margin fades
Forever and forever as I move."

✦ ✦ ✦

New Method of Removing Flux, and Welding or Brazing Scale Announced by Optimus Detergents Co.

HIGHLY satisfactory results removing flux, and welding and brazing scale using OPTIMUS Deoxidant No. 3, are reported by its maker, **Optimus Detergents Co.**, 251 Church Street, Matawan, N. J., manufacturers of industrial metal cleaning compounds. It is being used to deoxidize the surfaces of a wide variety of metals and alloys.

✦ ✦ ✦

NOT a bright dip, and not intended to replace acid in ordinary pickling, this Deoxidant being acidic in nature, may be used on most metals as a mild deoxidant without serious etching of the surface. It is used regularly on welded steel tubing, brazed, hot rolled and cold rolled steel, copper, brass, welded aluminum, cast iron, bronze castings and most aluminum alloys.

✦ ✦ ✦

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✦ ✦ ✦

THE complete line of Carboloy standard tools, tool blanks, masonry drills, and diamond impregnated grinding wheel dressers will be carried in stock atHarris Pump's headquarters on Brady and Sidney Streets, Pittsburgh, to serve the Pittsburgh area.

✦ ✦ ✦

Industrial and Commercial Gas Conference To Be Held in Toledo

Harry A. Sutton, Chairman of the Industrial and Commercial Gas Section, has announced that the 1946 American Gas Association Conference on Industrial and Commercial Gas will be held in Toledo, Ohio, Thursday and Friday, March 28th and 29th, at the Commodore Perry Hotel.

✦ ✦ ✦

A PROGRAM of value to all industrial and commercial gas men and appliance and equipment manufacturers is being planned by the Program Committee under the chairmanship of Ralph S. Wenner. The object of this conference, through the subjects to be discussed and the personal contacts which will be made, is to aid the industrial and commercial branches of the gas industry in the continuance of their efforts to have the service rendered by the gas industry used most extensively and efficiently during the reconversion and postwar periods.

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New Jersey Carbide Die Co., Jersey City 4, N. J.
Rusch Wire Die Corp., Croton-on-the-Hudson, N. Y.
Tungsten Electric Corp., Union City, N. J.
United Die Co., Newark, N. J.
Vascoloy-Ramet Corp., North Chicago, Ill.
Vianney Wire Die Wks., New York, N. Y.
Wayne Wire Die Co., Hillside, N. J.
Willey's Carbide Tool Co., Detroit, Mich.

DIES—Tantalum Carbide
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N. J.
Carboloy Co., Inc., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Kelly Wire Die Corp., New York, N. Y.
Metal Carbides Corp., Youngstown, O.
New Jersey Carbide Die Co., Jersey City 4, N. J.
Rusch Wire Die Corp., New York, N. Y.
United Die Co., Newark, N. J.
Vascoloy-Ramet Corp., North Chicago, Ill.
Vianney Wire Die Wks., New York, N. Y.
Willey's Carbide Tool Co., Detroit, Mich.

DIES—Tungsten Carbide
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N. J.
Carboloy Co., Inc., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Kelly Wire Die Corp., New York, N. Y.
Metal Carbides Corp., Youngstown, O.
Michigan Wire Die Works, Detroit, Mich.
Rusch Wire Die Corp., Croton-on-the-Hudson, N. Y.
Tungsten Electric Corp., Union City, N. J.
United Die Co., Newark, N. J.
Vascoloy-Ramet Corp., North Chicago, Ill.
Vianney Wire Die Wks., New York, N. Y.
Wayne Wire Die Co., Hillside, N. J.
Willey's Carbide Tool Co., Detroit, Mich.

DRAW BENCHES—
Ruesch, H. J., Machine Co., Newark, N. J.
Scudder, E. J., Foundry & Machine Co., Trenton, N. J.
Standard Machinery Co., Providence, R. I.
Vaughn Machinery Co., Cuyahoga Falls, O.

DRUMS—Flange Steel
Hubbard Spool Co., Chicago, Ill.
Stevens Metal Products Co., Niles, Ohio.

DRUMS—Vulcanizing
Mossberg Pressed Steel Corp., Attleboro, Mass.

DRYING & PRE-HEATING ROOMS
Carl-Mayer Corp., Cleveland, Ohio.
Industrial Oven Engr. Co., Cleveland, Ohio.

DRYING EQUIPMENT
Carl-Mayer Corp., Cleveland, Ohio.
Ross, J. O., Engineering Corp., New York, N. Y.

ENGINEERS—Consulting Wire Mill
Aufhauser Brothers Co., New York 5, N. Y.
Lewis, Kenneth B., Worcester, Mass.
Wiel, L D., New York, N Y.

EQUIPMENT—Humidifying
Niagara Blower Co., Buffalo, N. Y.

EQUIPMENT—Insulation Testing
Davis, R. L., Electric Co., Wallingford, Conn
Entwistle, James L., Co., Pawtucket, R. I.

EYELETS—Brass or Zinc
Platt Bros. & Co., The, Waterbury, Conn.

FENCES AND FENCING—Wire
Wickwire Spencer Steel Co., New York, N.Y.

FLASH BAKER—
Morrison Engineering Corp., Cleveland, O.

FLUXES—Soldering
American Chemical Paint Co., Ambler, Pa.

FOAM PRODUCING COMPOUNDS—
American Chemical Paint Co., Ambler, Pa.
Parkin, Wm. M., Co., Pittsburgh, Pa.

WHERE TO BUY, Continued

FRICTION PAY-OFF STANDS—
Industrial Oven Engr. Co., Cleveland, Ohio.

FURNACES—Annealing
Carl-Mayer Corp., The, Cleveland, Ohio.
Bellis Heat Treating Corp., Branford, Conn.
Electric Furnace Co., Salem, Ohio.
Furnace Engineers, Inc., Pittsburgh, Pa.
Morrison Engineering Corp., Cleveland, O.
Surface Combustion Corp., Toledo, Ohio.
Wilson, Lee, Engr. Co., Cleveland, Ohio.

FURNACES—Automatic
Carl-Mayer Corp., The, Cleveland, Ohio.
Electric Furnace Co., Salem, Ohio.
Morrison Engineering Corp., Cleveland, O.
Surface Combustion Corp., Toledo, Ohio.
Wilson, Lee, Engr. Co., Cleveland, Ohio.

FURNACES—Brazing
Electric Furnace Co., Salem, Ohio.
Firth-Sterling Steel Co., McKeesport, Pa.

FURNACES—Bright Annealing
Electric Furnace Co., Salem, Ohio.
Furnace Engineers, Inc., Pittsburgh, Pa.
Surface Combustion Corp., Toledo, Ohio.
Wilson, Lee, Engr. Co., Cleveland, Ohio.

FURNACES—Electric
Eisler Engineering Co., Newark 3, N. J.
Electric Furnace Co., Salem, Ohio.
Surface Combustion Corp., Toledo, Ohio.

FURNACES—Galvanizing Equipment
Electric Furnace Co., Salem, Ohio
Furnace Engineers, Inc., Pittsburgh, Pa.
Sleeper & Hartley, Inc., Worcester, Mass.
Surface Combustion Corporation, Toledo, O.
Wilson, Lee, Engineering Corp., Cleveland, Ohio

FURNACES—Hard'ing & Temp'ing
Bellis Heat Treating Corp., Branford, Conn.
Carl-Mayer Corp., The, Cleveland, Ohio.
Electric Furnace Co., Salem, Ohio.
Surface Combustion Corp., Toledo, Ohio.

FURNACES—Lead Melting
Electric Furnace Co., Salem, Ohio.
Furnace Engineers, Inc., Pittsburgh, Pa.
Robertson, John, Co., Brooklyn, N. Y.
Surface Combustion Corp., Toledo, Ohio.

FURNACES—Non-Oxidizing
Bellis Heat Treating Corp., Branford, Conn.
Carl-Mayer Corp., The, Cleveland, Ohio.
Electric Furnace Co., Salem, Ohio.
Furnace Engineers, Inc., Pittsburgh, Pa.
Morrison Engineering Corp., Cleveland, O.
Surface Combustion Corp., Toledo, Ohio.

FURNACES—Normalizing
Bellis Heat Treating Corp., Branford, Conn.
Carl-Mayer Corp., The, Cleveland, Ohio.
Electric Furnace Co., Salem, Ohio.
Furnace Engineers, Inc., Pittsburgh, Pa.
Morrison Engineering Corp., Cleveland, O.
Surface Combustion Corp., Toledo, Ohio.

FURNACES—Pot (Oil, Gas, Electric)
Bellis Heat Treating Corp., Branford, Conn.

FURNACES—Salt Bath
Bellis Heat Treating Corp., Branford, Conn.
Electric Furnace Co., Salem, Ohio.
Surface Combustion Corporation, Toledo, Ohio.

FURNACES—Wire, Strip & Sheet
Bellis Heat Treating Corp., Branford, Conn.
Carl-Mayer Corp., The, Cleveland, Ohio.
Eisler Engineering Co., Newark 3, N. J.
Electric Furnace Co., Salem, Ohio.
Furnace Engineers, Inc., Pittsburgh, Pa.
Morrison Engineering Corp., Cleveland, O.
Surface Combustion Corp., Toledo, Ohio.
Wilson, Lee, Engr. Co., Cleveland, Ohio.

FURNACES—Galvanizing Equipment
Furnace Engineers, Inc., Pittsburgh, Pa.
Wilson, Lee, Engr. Co., Cleveland, Ohio

GALVANIZING KETTLES
National Annealing Box Co., Washington, Penna.

GRINDERS—Roll
Norton Co., Worcester, Mass.

HOISTS—Electric Travelling
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, Ohio.

INHIBITORS—Pickling
American Chemical Paint Co., Ambler, Pa.
Oakite Products, Inc., New York, N. Y.
Parkin, Wm. M. Co., Pittsburgh, Pa.

INSULATING LACQUERING SYSTEMS—Continuous
Industrial Oven Engr. Co., Cleveland, Ohio.

INSULATING MATERIALS—
Angier Sales Corp., Framingham, Mass
Crepe-Kraft Co., Newark, N. J.
Du Pont de Nemours, E. I., & Co., Wilmington, Delaware
Standard Varnish Works, Staten Island, N. Y.

KETTLES—Galvanizing, Annealing, Tinning, etc.
National Annealing Box Co., Washington, Penna.

LATHES—Die Reaming
Carboloy Co., Inc., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Morgan Construction Co., Worcester, Mass.
Roos, H. & G., Tool & Mfg. Co., Montclair, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry & Machine Co., Waterbury, Conn.

LIME—
Warner Co., Philadelphia and Bellefonte, Pa.

LININGS—Acid and Alkali Proof
Ceilcote Co., The, Cleveland, Ohio.
Haveg Corp., Newark, Del.
Heil Engineering Co., Cleveland, Ohio.

LUBRICANTS—For Metal Cutting, Stamping and Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Magnus Chemical Co., Garwood, N. J.
Miller, R. H., Co., Inc., Homer, N. Y.
Oakite Products, Inc., New York, N. Y.
Standard Industrial Compounds Co., Chicago, Ill.

LUBRICANTS—Wire Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Bick, Hans C., Inc., Reading, Pa.
Magnus Chemical Co., Garwood, N. J.
Miller, R. H., Co., Inc., Homer, N. Y.
Oakite Products, Inc., New York, N. Y.
Procter & Gamble, Cincinnati, Ohio
Standard Industrial Compounds Co., Chicago, Ill.

MACHINERY—Armoring (Cable, Wire Hose)
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Braiding
Mossberg Pressed Steel Corp., Attleboro, Mass.
New England Butt Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Brazing
Syncro Machine Co., Perth Amboy, N. J.

MACHINERY—Bunching
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.

MACHINERY—Bundling, Scrap
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Cable, Electric
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Cable Reel Boring
Root, B. M., Co., York, Pa.

MACHINERY—Chain Making
Wilson, A. H., Machine Co., The, Bridgeport, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Cable, Rope Closing
New England Butt Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Coil Winding
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.

MACHINERY—Coil Wrapping
Angier Sales Corp., Framingham, Mass.

MACHINERY— Coilers
Broden Construction Co., Cleveland, Ohio.
Eisler Engineering Co., Newark 3, N. J.
Morgan Construction Co., Worcester, Mass.
New England Butt Co., Providence, R. I.
Ruesch, H. J., Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY — Cold Heading with Wire Drawing Attachment
Ajax Manufacturing Co., Cleveland, Ohio.

MACHINERY—Copper Wire Drawing and Rolling
American Insulating Mach'y Co., Phila., Pa.
Ruesch, H. J., Machine Co., Newark, N. J.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Covering Wire
American Insulating Mach'y Co., Phila., Pa.
Royle, John & Sons, Paterson, N. J.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Cutting
Ajax Manufacturing Co., Cleveland, Ohio.
Broden Construction Co., Cleveland, Ohio.
Eisler Engineering Co., Newark 3, N. J.
Lewis Machine Co., The, Cleveland, Ohio.
Moslo Machinery Inc., Cleveland, Ohio.
National Machinery Exchange (Used), New York, N. Y.
Nilson, A. H., Machine Co., The, Bridgeport, Conn.
Porter, H. K., Inc., Everett, Mass.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Die Making
Carboloy Co., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Roos, H. & G., Tool & Mfg. Co., Montclair, N. J.
Wayne Wire Die Co., Hillside, N. J.

MACHINERY—Draw Benches
Ajax Manufacturing Co., Cleveland, Ohio.
Broden Construction Co., Cleveland, Ohio.
Morgan Construction Co., Worcester, Mass.
Ruesch, H. J., Machine Co., Newark, N. J.
Standard Machinery Co., Providence, R. I.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Edging
Broden Construction Co., Cleveland, Ohio.
Standard Machinery Co., Providence, R. I.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Enameling
American Insulating Mach'y Co., Phila., Pa.
Industrial Oven Engineering Co., Cleveland, Ohio.
Syncro Machine Co., Perth Amboy, N. J.

MACHINERY—Extruding
Robertson, John, Co., Brooklyn, N. Y.
Royle, John, & Sons, Paterson, N. J.

MACHINERY—Fence
Broden Construction Co., Cleveland, Ohio
Glader, Wm., Machine Works, Chicago, Ill.

MACHINERY—Filament Coil Winding
Eisler Engineering Co., Newark 3, N. J.

MACHINERY—Flat Wire
Broden Construction Co., Cleveland, Ohio.
Ruesch, H. J., Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY— Forming
Eisler Engineering Co., Newark 3, N. J.
National Machinery Exchange (Used), New York, N. Y.
Nilson, A. H., Machine Co., The, Bridgeport, Conn.
O'Neil-Irwin Mfg. Co., Minneapolis, Minn.
Seifert, E. R., Inc., Syracuse, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Machinery Co., Providence, R. I.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Galvanizing
Wilson, Lee, Engr. Co., Cleveland, Ohio.

MACHINERY—Galvanizing Wire
Broden Construction Co., Cleveland, Ohio.
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.
Wilson, Lee, Engr. Co., Cleveland, Ohio.

MACHINERY—Gang Winders
Ruesch, H. J., Machine Co., Newark, N. J.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Grinding
Norton Co., Worcester, Mass.

MACHINERY—Insulating
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Royle, John, & Sons, Paterson, N. J.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Lead Encasing Presses, etc.
Robertson, John, Co., Brooklyn, N. Y.

MACHINERY—Lead Stripping
Robertson, John, Co., Brooklyn, N. Y.

MACHINERY—Lock Washer
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Magnet Wire
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Material Handling
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, Ohio.

WHERE TO BUY, Continued

MACHINERY—Measuring Wire & Cable
Durant Mfg. Co., Milwaukee, Wis.
Lyon-Vail Machine Co., Brockton, Mass.
New England Butt Co., Providence, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Nail and Tack
Broden Construction Co., Cleveland, Ohio.
Glader, Wm., Machine Works, Chicago, Ill.
National Machinery Exchange (Used), New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Panning
American Insulating Mach'y Co., Phila., Pa.
Syncro Machine Co., Perth Amboy, N. J.

MACHINERY—Pointing
Broden Construction Co., Cleveland, Ohio.
Morgan Construction Co., Worcester, Mass.
Ruesch, H. J., Machine Co., Newark, N. J.
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Machinery Co., Providence, R. I.
Superior Tool & Mfg. Co., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Rod Mill
Broden Construction Co., Cleveland, Ohio.
Morgan Construction Co., Worcester, Mass.
Ruesch, H. J., Machine Co., Newark, N. J.

MACHINERY—Rolling Mill
Broden Construction Co., Cleveland, Ohio.
Morgan Construction Co., Worcester, Mass.
National Machinery Exchange (Used), New York, N. Y.
Ruesch, H. J., Machine Co., Newark, N. J.
Standard Machinery Co., Providence, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Rubber for Insulating Wire
Royle, John, & Sons, Paterson, N. J.

MACHINERY—Rubber Tubing and Straining
New England Butt Co., Providence, R. I.
Royle, John, & Sons, Paterson, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Screw Wire
National Machinery Exchange (Used), New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Special
American Insulating Mach'y Co., Phila., Pa.
Broden Construction Co., Cleveland, Ohio.
Emory, Robert J., Co., Newark, N. J.
New England Butt Co., Providence, R. I.
Nilson, A. H., Machine Co., Bridgeport, Conn.
Ruesch, H. J., Machine Co., Newark, N. J.
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Machinery Co., Providence, R. I. (Special Designs)
Superior Tool & Mfg. Co., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Spooling
American Insulating Mach'y Co., Phila., Pa.
Eisler Engineering Co., Newark 3, N. J.
Emory, Robert J., Co., Newark, N. J.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Spring Making
National Machinery Exchange (Used), New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Staple
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Straightening
Ajax Manufacturing Co., Cleveland, Ohio.
Broden Construction Co., Cleveland, Ohio.
Lewis Machine Co., The, Cleveland, Ohio.
Moslo Machinery Co., Cleveland, Ohio.
National Machinery Exchange (Used), New York, N. Y.
Nilson, A. H., Machine Co., The, Bridgeport, Conn.
Ruesch, H. J., Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Stranding
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Strip Steel
Broden Construction Co., Cleveland, Ohio.
Ruesch, H. J., Machine Co., Newark, N. J.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Swaging
National Machinery Exchange (Used), New York, N. Y.
Ruesch, H. J., Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Machinery Co., Providence, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Taping
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Testing Equipment—Sparkers
Davis, R. L., Electric Co., Wallingford, Conn.
Entwistle, Jas. L., Pawtucket, R. I.

MACHINERY—Testing Spring
Standard Machinery Co., Providence, R. I.

MACHINERY—Tinsel Rolling Mills
American Insulating Mach'y Co., Phila., Pa.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Trolley Wire
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Tube Mill
Ruesch, H. J., Machine Co., Newark, N. J.
Torrington Mfg. Co, Torrington, Conn.

MACHINERY—Welding Wire
Aufhauser Brothers Co., New York 5, N. Y.
Eisler Engineering Co., Newark 3, N. J.
Micro Products Co., Chicago, Ill.
Moslo Machinery Co., Cleveland, Ohio.
Syncro Machine Co., Perth Amboy, N. J.

MACHINERY—Winding
American Insulating Mach'y Co., Phila., Pa.
Eisler Engineering Co., Newark 3, N. J.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Mill Supply Co., Providence, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co, Torrington, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY — Wind-up (Constant Tension, Variable Speed
Industrial Oven Engr. Co., Cleveland, Ohio.
Watson Machine Co., Paterson, N. J.

MACHINERY—Wire Bending
Eisler Engineering Co., Newark 3, N. J.
Nilson, A. H., Co., Bridgeport, Conn.
O'Neil-Irwin Mfg. Co., Minneapolis, Minn.

MACHINERY—Wire Drawing
Ajax Manufacturing Co., Cleveland, Ohio.
American Insulating Mach'y Co., Phila., Pa.
Broden Construction Co., Cleveland, Ohio.
Eisler Engineering Co., Newark 3, N. J.
Morgan Construction Co., Worcester, Mass.
National Machinery Exchange (Used), New York, N. Y.
Ruesch, H. J., Machine Co., Newark, N. J.
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Machinery Co., Providence, R. I.
Superior Tool & Mfg. Co., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Wire Rope
New England Butt Co., Providence, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Wire Tinning
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Syncro Machine Co., Perth Amboy, N. J.

MACHINERY—Wood Screw
National Machinery Exchange (Used), New York, N. Y.

MATERIAL HANDLING EQUIPMENT—
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, O.

MILLS—Tandem Rolling and Edging
Standard Machinery Co., Providence, R. I.
Torrington Mfg. Co. Torrington, Conn.

NAILS—Wire
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Youngstown Sheet & Tube Co., Youngstown, Ohio.

NICKEL SILVER AND PHOSPHOR BRONZE—Rod, Wire and Strip
Hudson Wire Co., Ossining, N. Y.

OILS—Wire Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Miller, R. H., Co., Inc., Homer, N. Y.
Oakite Products, Inc., New York, N. Y.
Procter & Gamble, Cincinnati, Ohio
Standard Industrial Compounds Co., Chicago, Ill.

OVENS—Cable Lacquering
American Insulating Mach'y Co., Philadelphia, Pa.
Industrial Oven Engr. Co., Cleveland, Ohio.
Morrison Engineering Corp., Cleveland, O.

OVENS—Dehydrogenizing
Carl-Mayer Corp., Cleveland, Ohio.
Industrial Oven Engr. Co., Cleveland, Ohio.

OVENS—Industrial
Carl-Mayer Corp., The, Cleveland, Ohio.
Industrial Oven Engr. Co., Cleveland, Ohio.
Morrison Engineering Corp., Cleveland, O.
Ross, J. O., Engineering Corp., New York, N. Y.

OVENS—Welding Rod Coating
Carl-Mayer Corp., The, Cleveland, Ohio.
Industrial Oven Engr. Co., Cleveland, Ohio.
Morrison Engineering Corp., Cleveland, O.
Moslo Machinery Co., Cleveland, Ohio.

PAINTS—Heat Resisting
American Chemical Paint Co., Ambler, Pa.

PAINTS—Marine
American Chemical Paint Co., Ambler, Pa.

PAINTS—Structural Steel
American Chemical Paint Co., Ambler, Pa.

PANS—Lead and Spelter
National Annealing Box Co., Washington, Penna.

PANS—Vulcanizing
Mossberg Pressed Steel Corp., Attleboro, Mass.

PAPER—Corrosion Preventive
Angier Sales Corp., Framingham, Mass.

PAPER—Creped Wrapping
Crepe-Kraft Co., Newark, N. J.

PAPER—For Coil, Wrapping and Corrosion Prevention
Angier Sales Corp., Framingham, Mass.
Crepe-Kraft Co., Newark, N. J.

PATENT ATTORNEYS—
Lancaster, Allwine and Rommel, Washington, D. C.

PICKLING COMPOUNDS—
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Oakite Products, Inc., New York, N. Y.
Parkin, Wm. M., Co., Pittsburgh, Pa.

PICKLING TANK LININGS—
Ceilcote Co., The, Cleveland, Ohio.
Haveg Corp., Newark, Del.
Heil Engineering Co., Cleveland, Ohio.
Keagler Brick Co., Steubenville, Ohio.
Sauereisen Cement Co., Pittsburgh, Pa.

PIPES & FITTINGS—Acid Resistant
Ceilcote, The, Co., Cleveland, Ohio
Haveg Corp., Newark, Del.
Heil Engineering Co., Cleveland, Ohio.

POTS—Lacquer
Industrial Oven Engr. Co., Cleveland, Ohio.

POTS—Lead Melting
National Annealing Box Co., Washington, Pa.
Robertson, John, Co., Brooklyn, N. Y.

POWDER—Wire Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Magnus Chemical Co., Garwood, N. J.
Miller, R. H., Co., Homer, N. Y.
Potter, Neil C., Newark, N. J.
Standard Industrial Compounds Co., Chicago, Ill.

PRESSES—Hydraulic and Mechanical
Robertson, John, Co., Brooklyn, N. Y.
Standard Machinery Co., Providence, R. I. (Mechanical Only)

PRESSES—Lead
Robertson, John, Co., Brooklyn, N. Y.

PRESSURE VESSELS—
National Annealing Box Co., Washington, Penna.

PULLERS—Wire
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.

PUMPS—Hydraulic
Robertson, John, Co., Brooklyn, N. Y.

REEL AND TENSION STAND—
Industrial Oven Engr. Co., Cleveland, O.
Moslo Machinery Co., Cleveland, Ohio.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

REEL CRUTCHES—
Watson Machine Co., Paterson, N. J.

REELS—Annealing and Stranding
Apco Mossberg Co., Attleboro, Mass.
Hayward, R. B., Co., Chicago, Ill.
Hubbard Spool Co., Chicago, Ill.
Moslo Machinery Co., Cleveland, Ohio.
Mossberg Pressed Steel Corp., Attleboro, Mass.

WHERE TO BUY, Continued

Stevens Metal Products Co., Niles, Ohio.

REELS—Steel
Apco Mossberg Co., Attleboro, Mass.
Hayward, R. B., Co., Chicago, Ill.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, Ohio.

REELS AND SPOOLS—Shipping and Shop
Apco Mossberg Co., Attleboro, Mass.
Bridge Mfg. Co., Inc., The, Hazardville, Conn.
Hayward, R. B., Co., Chicago, Ill.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, Ohio.

REELS—Takeoff
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Moslo Machinery Co., Cleveland, Ohio.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, Ohio.

REELS—Vulcanizing & Impregnating
Apco Mossberg Co., Attleboro, Mass.
Hayward, R. B., Co., Chicago, Ill.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, Ohio.

REELS—Wire Drawing
Apco Mossberg Co., Attleboro, Mass.
Hayward, R. B., Co., Chicago, Ill.
Hubbard Spool Co., Chicago, Ill.
Moslo Machinery Co., Cleveland, Ohio.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, Ohio.

REELS—Wooden
Bridge Mfg. Co., Inc., The, Hazardville, Conn.

REFACTORIES—High Temperature
Norton Company, Worcester, Mass.

ROD BAKERS—
Carl-Mayer Corp., The, Cleveland, Ohio.
Morrison Engineering Corp., Cleveland, O.
Moslo Machinery Co., Cleveland, Ohio
Ross, J. O., Engineering Corp., New York, N. Y.

RODS—Wire—Non-Ferrous
American Brass Co., The, Waterbury, Conn.
Hudson Wire Co., Ossining, N. Y.
Platt Bros. & Co., The, Waterbury, Conn.

RODS—Wire—Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Indiana.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Roebling's, John A., Sons Co., Trenton, N. J.
Wickwire Spencer Steel Co., New York, N. Y.
Youngstown Sheet & Tube Co., Youngstown, Ohio.

ROLL STRAIGHTENERS—
Moslo Machinery Co., Cleveland, Ohio.

ROPE—Wire
Bethlehem Steel Co., Bethlehem, Pa.
Brewer Mfg. Co., Muncy, Pa.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Roebling's, John A., Sons Co., Trenton, N. J.
Wickwire Spencer Steel Co., New York, N. Y.
Stevens Metal Products Co., Niles, Ohio

RUST PROOF COMPOUNDS—
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Oakite Products, Inc., New York, N. Y.

RUST REMOVING COMPOUNDS—
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Heil Engineering Co., Cleveland, Ohio
Standard Industrial Compounds Co., Chicago, Ill.

SATURATION SYSTEMS—
Industrial Oven Engr. Co., Cleveland, Ohio.
Watson Machine Co., Paterson, N. J.

SHEARS—
O'Neil-Irwin Mfg. Co., Minneapolis, Minn.

SHEET—Steel
Continental Steel Corp., Kokomo, Indiana.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.

SOAPS—Industrial and Wire Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Bick, Hans C., Inc., Reading, Pa.
Magnus Chemical Co., Garwood, N. J.
Miller, R. H., Co., Inc., Homer, N. Y.
Potter, Neil C., Newark, N. J.
Procter & Gamble, Cincinnati, Ohio
Standard Industrial Compounds Co., Chicago, Ill.

SOLVENT RESIN SYSTEMS—Experimental
Industrial Oven Engr. Co., Cleveland, Ohio.

SPOOLS—Annealing and Wire Drawing
Apco Mossberg Co., Attleboro, Mass.
Hayward, R. B., Co., Chicago, Ill.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, Ohio.

SPOOLS—Shipping and Shop
Apco Mossberg Co., Attleboro, Mass.
Clark, J. L. Mfg. Co., Rockford, Ill.
Hayward, R. B., Co., Chicago, Ill.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, Ohio.

SPOOLS—Steel
Apco Mossberg Co., Attleboro, Mass.
Clark, J. L., Mfg. Co., Rockford, Ill.
Hayward, R. B., Co., Chicago, Ill.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, Ohio.

SPRINGS—Steel
Wickwire Spencer Steel Co., New York, N. Y.

STAMPINGS—Steel
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.

STRAND—Steel and Copper
Brewer Mfg. Co., Williamsport, Pa.
Wickwire Spencer Steel Co., New York, N. Y.

STRIP—Brass and Non-Ferrous
Hudson Wire Co., Ossining, N. Y.

STRIP—Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Firth-Sterling Steel Co., McKeesport, Pa.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Roebling's, John A., Sons Co., Trenton, N. J.
Wickwire Spencer Steel Co., New York, N.Y.

SWIFTS—Take-off
Apco Mossberg Co., Attleboro, Mass.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Watson Machine Co., Paterson, N. J.

TANK LININGS—Brick
Ceilcote Co., The, Cleveland, Ohio.
Keagler Brick Co., Steubenville, Ohio.
Nukem Products Corp., Buffalo, N. Y.

TANKS—Compound
Haveg Corp., Newark, Del.
Watson Machine Co., Paterson, N. J.

TANKS—Pickling
Ceilcote Co., The, Cleveland, Ohio.
Haveg Corp., Newark, Del.
Heil Engineering Co., Cleveland, Ohio.
Nukem Products Corp., Buffalo, N. Y.
Sauereisen Cements Co., Pittsburgh, Pa.

TANKS—Steel
Mossberg Pressed Steel Corp., Attleboro, Mass.
National Annealing Box Co., Washington, Pa.

TESTING INSTRUMENTS—
Davis, R. L., Electric Co., Wallingford, Conn.

TOOLS—Wire Cutting
Porter, H. K., Inc., Everett, Mass.

TRAMRAIL SYSTEMS—
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, Ohio.

TRAVERSES—For Reels
Hubbard Spool Co., Chicago, Ill.
Stevens Metal Products Co., Niles, Ohio.

TRAVERSE MECHANISMS—
Apco Mossberg Co., Attleboro, Mass.
Mossberg Pressed Steel Co., Attleboro, Mass.
New England Butt Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

TREADS—Safety
Norton Co., Worcester, Mass.

TUBE BENDERS AND FORMERS—
Ruesch, H. J., Machine Co., Newark, N. J.

TURKS HEADS—Friction and Power
Standard Machinery Co., Providence, R. I.

VALVES AND FITTINGS—Acid Resistant
Haveg Corp., Newark, Del.

VARNISHES—For Insulation
Standard Varnish Works, Staten Island, N.Y.

VULCANIZERS—
Watson Machine Co., Paterson, N. J.

VULCANIZING PANS—
American Insulating Mach'y Co., Phila., Pa.
Mossberg Pressed Steel Corp., Attleboro, Mass.

WELDERS—Spot and Butt
Eisler Engineering Co., Newark 3, N. J.
Micro Products Co., Chicago, Ill.
Moslo Machinery Co., Cleveland, Ohio.

WIND-UP AND UNWIND SYSTEMS—Continuous
American Insulating Mach'y Co., Philadelphia, Pa.
Davis, R. L., Electric Co., Wallingford,
Entwistle, James L., Co., Pawtucket, R. I.
Industrial Oven Engr. Co., Cleveland, Ohio.
Watson Machine Co., Paterson, N. J.

WIRE—Aluminum
Aluminum Co. of America, Pittsburgh, Pa.

WIRE—Cast
Youngstown Sheet & Tube Co., Youngstown, Ohio.

WIRE—Cold Heading
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Indiana.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Roebling's, John A. Sons, Co., Trenton, N. J.
Youngstown Sheet & Tube Co., Youngstown, Ohio.

WIRE—Electric
American Brass Co., The, Waterbury, Conn.
Callite Tungsten Corp., Union City, N. J.
Hudson Wire Co., Ossining, N. Y.
Seneca Wire & Mfg. Co., The, Fostoria, O.

WIRE—Enameled for Coils
North American Philips Corp., Dobbs Ferry, N. Y.
Winsted Div. of Hudson Wire Co., Winsted, Conn.

WIRE—Manufacturers
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Firth-Sterling Steel Co., McKeesport, Pa.
Johnson Steel & Wire Co., Inc., Worcester 1, Mass.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Roebling's, John A. Sons, Co., Trenton, N. J.
Seneca Wire & Mfg. Co., The, Fostoria, O.
Spencer Wire Co., West Brookfield, Mass.
Wickwire Spencer Steel Co., New York, N. Y.
Youngstown Sheet & Tube Co., Youngstown, Ohio.

WIRE—Music
American Brass Co., The, Waterbury, Conn.
Callite Tungsten Corp., Union City, N. J.
Johnson Steel & Wire Co., Inc., Worcester 1, Mass.
Spencer Wire Co., West Brookfield, Mass.
Seneca Wire & Mfg. Co., The, Fostoria, O.

WIRE—Nickel Silver and Phosphor Bronze
American Brass Co., The, Waterbury, Conn.
Callite Tungsten Corp., Union City, N. J.
Hudson Wire Co., Ossining, N. Y.

WIRE—Non-Ferrous to Specification for Special Purposes
Callite Tungsten Corp., Union City, N. J.
Hudson Wire Co., Ossining, N. Y.
North American Philips Corp., Dobbs Ferry, N. Y.
Winsted Div. of Hudson Wire Co., Winsted, Conn.

WIRE—Spring
American Brass Co., The, Waterbury, Conn.
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Firth-Sterling Steel Co., McKeesport, Pa.
Johnson Steel & Wire Co., Inc., Worcester 1, Mass.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Seneca Wire & Mfg. Co., The, Fostoria, O.
Wickwire Spencer Steel Co., New York, N. Y.

WIRE—Stainless Steel
Callite Tungsten Corp., Union City, N. J.
Firth-Sterling Steel Co., McKeesport, Pa.
Spencer Wire Co., West Brookfield, Mass.

WIRE—Steel—Also Coppered Steel—Also Galvanized Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Firth-Sterling Steel Co., McKeesport, Pa.
Johnson Steel & Wire Co., Inc., Worcester 1, Mass.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Seneca Wire & Mfg. Co., The, Fostoria, O.
Spencer Wire Co., West Brookfield, Mass.
Wickwire Spencer Steel Co., New York, N. Y.

WIRE—Tungsten
Callite Tungsten Corp., Union City, N. J.

WIRE—Zinc
Platt Bros. & Co., The, Waterbury, Conn.

WIRE, WEAVING—Non-Ferrous
Hudson Wire Co., Ossining, N. Y.

WIRE WINDER—
Standard Mill Supply Co., Providence, R. I.

WRAPPING PAPER—Creped
Crepe-Kraft Co., Newark, N. J.

YARNS & TAPES—
Du Pont de Nemours, E. I., & Co., Wilmington, Delaware

The WATSON MACHINE COMPANY
ESTABLISHED 1845
PATERSON, NEW JERSEY, U. S. A.

Wire & Wire Products
January, 1946

ELECTRICAL WIRE AND CABLE AND WIRE ROPE MACHINERY

"SUBMERGENCE" COMPOUND TANKS

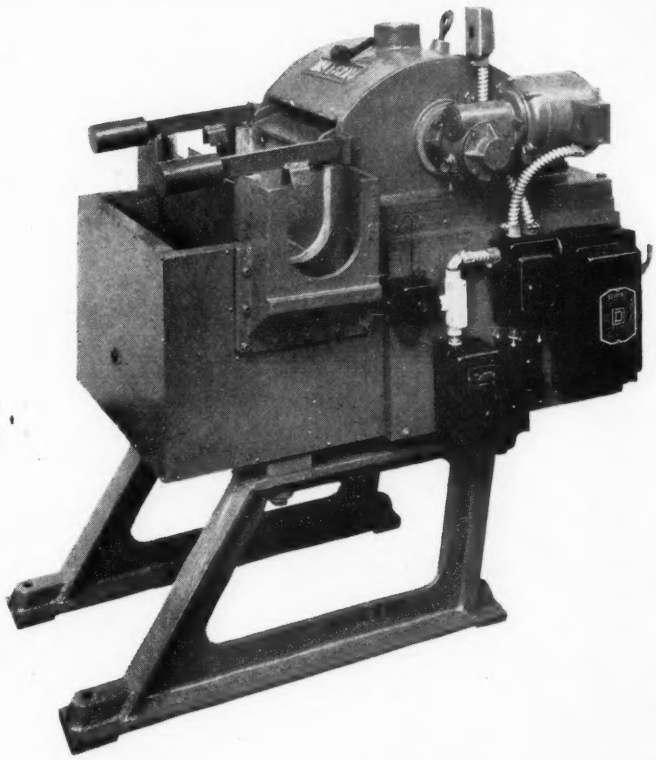
These tanks, primarily designed for large cables and for joint operation with heavy Armoring Machines, apply a coating of hot compound by complete immersion of the cable during machine passage. Built for STEAM or ELECTRIC Heating. Standard immersion lengths are 18, 24, 30 and 36 inches. Standard units allow passage of cables to 5″ diameter.

* * *

The outstanding advantages of this design are ACCESSIBILITY and complete FREEDOM FROM MECHANICAL TROUBLE.

* * *

Sawed-out wooden collars, having passage hole with ample cable diameter clearance, restrict the return flow of compound and maintain pond-level. Removable hinged weights on split collars, permit removal of minor obstructions without gate collar removal.



* * *

Pond Tank and Pump Hood are easily removed for cleaning of tank. A 2″ Drain is provided. Tank sides and bottom are insulated with insulation protected by a sheet metal cover.

* * *

The motorized wheel pump insures an even and ample flow of hot compound and provides convection heating. This pump eliminates any possibility of mechanical trouble where foreign objects are present in the compound.

* * *

"STEAM" Tanks are jacketted all around and cast in one piece for working pressures of up to 150 PSI. Tapped bosses are provided for the insertion of immersion heaters for temperatures above that of steam.

* * *

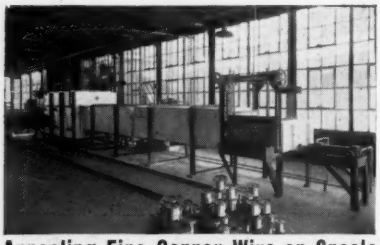
"ELECTRICAL" unit (shown here on cut W-2950) has removable resistance heaters in tank bottom. Automatic Thermostatic Heat Control is adjustable for temperatures to 450° F. Available for 110, 220 and 440 Volt Current. Line Disconnection Switch, Signal Light and Thermometer are extras.

* * *

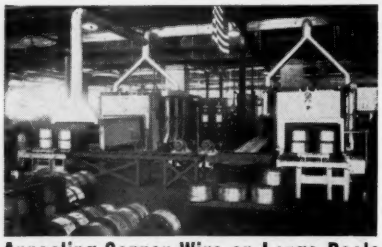
Offset standard base legs, permit easy access to pond and controls. They are for 6″ H-Beams spaced on 36″ CL. to CL. to result in 40″ axial height above floor, i.e., our standard machine height.

EF FURNACES

For Every Industrial Heat Treating Process



Annealing Fine Copper Wire on Spools
This EF special atmosphere continuous pusher type furnace bright anneals 800 lbs. fine copper wire on spools per hour. We build them in larger or smaller sizes as required.



Annealing Copper Wire on Large Reels
The two EF combination electric and gas fired radiant tube furnaces shown above are bright annealing 5,000 lbs. of copper wire on reels per hour, continuously.

Brass, Bronze, Nickel Silver, and Copper
Wire on spools and reels, and strip and wire in coils are clean and bright annealed, continuously, in EF pusher, bulkhead tray type furnaces similar to the above.

For Production Furnaces

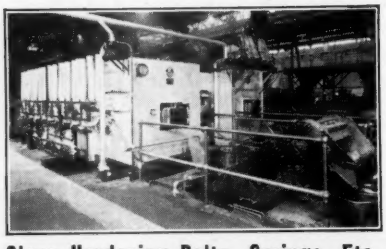
For Handling Wire, Rod, Strip, Bolts, Springs
or other products in any size or shape

For Production Furnaces
For Any Process or Production

Consult EF Engineers

No Job Is Too Large or Too Unusual

Annealing High Carbon Wire and Rod
High carbon wire and rod are uniformly annealed without decarburization in the above EF pit type furnaces. We build electric or fuel fired furnaces for every industrial heat treating process.



Clean Hardening Bolts, Springs, Etc.
EF chain belt conveyor furnaces are built in sizes to handle from 175 to 2,000 lbs. per hour—electric or fuel fired. The above gas fired radiant tube furnace is scale-free hardening bolts.

Bright Annealing Steel Strip, Rod, Wire
EF gas fired bell type furnaces maintain uniform temperature throughout the charge regardless of the weight or height of charge. Above installation is bright annealing cold rolled strip.

The Electric Furnace Co., Salem, Ohio

Gas Fired, Oil Fired and Electric Furnaces---For Any Process, Product or Production

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type furnaces

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Production
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Unusual

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